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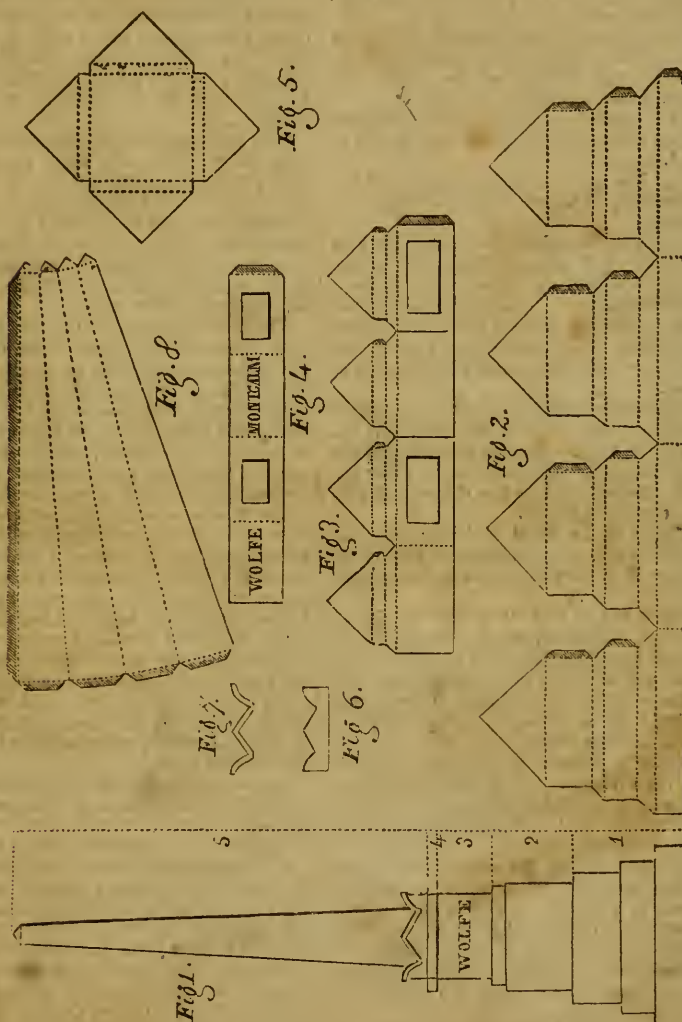
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. III. NEW SERIES. | SATURDAY, JAN. 19, 1839. (PRICE ONE PENNY.) | No. CXXIV. OLD SERIES.

MODELLING IN PAPER.



City Press, 1, Long Lane, Aldersgate Street; D. A. Doudney.

MODELLING IN PAPER.

NO. III.

(See Engraving, front page)

To the Editor of the Mechanic and Chemist.

Sir,—The subject of the present paper is a monument, erected to the memory of Wolfe and Montcalm, in America; and to demonstrate the way to execute a model of it is the object of this, my third and concluding paper.

The student's own discretion will at once tell him which of the dotted lines are to be cut half through on the inside, and which on the outside of the paper.

This model is executed in five separate pieces, which are numbered at the side of fig. 1.

Fig. 1 is an elevation of one side of the monument, to which the other three are similar.

Fig. 2 denotes how to model the first division. It is directly seen that all the angles to which the paper is to be bent are angles of 90°. The triangular finishes at the top of fig. 2 will (if bent until they touch each other) form a flat square surface, on which the second division will be glued.

Fig. 3 shows how to model the second division. The remarks on fig. 2 will apply here; and let me also observe that the small tablets are constructed by cutting a piece of cardboard to the shape, and gluing it on very neatly.

Fig. 4 is the third division; here the words Wolfe and Montcalm are to be written, and the two tablets constructed in the above way.

Fig. 5 shows how to model the fourth division, on which, when completed, the pyramid will be glued. The ornamental parts are effected by cutting out four pieces of paper, in the shape of fig. 6, and gluing a piece of paper, in the shape of fig. 7, on each other.

Fig. 8 is the way to model the pyramid or fifth division. As I gave, in my last, the way to model an octagonal pyramid, the student will find this division very easy to model.

The best cement for modelling in paper is one which dries as soon as applied. There is a cement, having this property, called Indian glue. The model can, when finished, be slightly pencilled over with thin plaster of Paris, in order to imitate stone; but, having tried it, I think it is no improvement.

Thinking that enough has now been said, by which a person can understand something of "papyro plastics," and hoping that this will prove generally interesting, I remain, your obedient servant,

Trinity Square, Southwark. F. P.

METEOROLOGICAL SOCIETY.

Jan. 8, 1839.

Dr. M'Intyre, V. P., F.L.S., &c., in the Chair.

After the minutes of the last meeting were read and confirmed, M. Julien Desjardins, of the Mauritius, was elected Associate. Donations of books were announced from the Geographical Establishment, Brussels; from Professor Silliman, New Haven; and W. C. Reafield, esq., New York, U. S.

The Secretary read an interesting paper from J. H. Heaverly, esq., Royal Academy, Gosport, on the peculiar weather of December last, which, he stated, was alternately wet and fine, with a pretty high atmospheric pressure; and that the mean temperature of the month was little short of the mean temperature of December for several years,—41°· 42, Far.

The thunderstorm on the 2nd is stated as a storm of rain, hail, wind, thunder, and lightning, and came on suddenly from the S. W., at 15 min. past 10, P.M. The hailstones were not coated with snow, but were solid pieces of ice, in a great variety of forms, viz. circular, oval, cylindrical, conical, lenticular, and triangular; and in descending through a cold region, five, six, and even seven, hailstones had joined themselves firmly together in solid masses of transparent ice, many of which measured upwards of two inches round, and some of them between two and three inches long, which broke not less than 8000 panes of glass in Portsea, Portsmouth, and Gosport, besides doing much damage to the roofs of houses, &c. The wind, lightning, and detonating peals of thunder, in quick succession, combined with the noise of the hail-stones, were sufficient to awe the stoutest heart.

In twenty minutes there fell three-fifths of an inch of rain and dissolved hailstones.

The meteors on the following night, the 3rd, from half-past seven until ten, P.M., amounted to 97; they appeared in different parts of the celestial hemisphere; 56 fell eastward of the meridian, and 41 westward of it; the greatest number, to the eastward, appeared in that part of the heavens occupied by the constellations Aurigu, Taurus, Orion, Curis Minor, and Gemini; and the greatest number westward, was in and near the Harp, the Dolphin, the Swan, and the Dragon; but

they were described as falling in every direction, from the zenith to the horizon nearly. Seven had long sparkling trains, and passed through spaces of 20, 25, and 30 degrees. The writer of the paper conjectures that these meteors were generated by means of a gaseous fluid mixing with the lower medium of the atmosphere, which he thinks was highly electric, as it had rained all day, with a rising barometer.

The Secretary next read letters from J. G. Tatum, esq., on the excess of rain that falls at Wendover, nine miles from High Wycombe, over that which falls annually at the latter place, which, during the year 1838, was 4½ inches. Wendover, according to Colonel Mudge's Trigonometrical Suryey, lies 905 feet above the level of the sea. The cause, therefore, of the excess of rain at Wendover is attributed to the great elevation of the hills above Wycombe. This letter was accompanied by a table of the temperature, rain, and winds, for the whole year, kept by the Rev. Thomas Skeen, who has kept a similar table for 40 years, and always finds a great excess of rain over Wycombe, and sometimes to an amount much greater than that above quoted. The quantity of rain fallen at Wendover was, in 1838, 29·245 inches.

The meeting adjourned till the second Tuesday in February.

BUILDING CEMENT.

To the Editor of the Mechanic and Chemist.

Sir,—Some years ago a gentleman, named Beavan, made an important improvement in the manufacture of building cement, a description of which will no doubt be of service to many of your readers.

It consists of a composition of marble, flint, chalk, lime, and water, which, when dry, is capable of being brought to a high state of polish. The proportions are—one part of pulverized marble, one part of pulverized flint, and one part of chalk, mixed together, and sifted through a very fine sieve; to this is to be added, one other part of lime, which has been slacked at least three months; and to these a sufficient quantity of water to make the whole into a thin paste; and in that state it is to be spread as thinly as possible over a coarse ground, and brought to a smooth surface by the trowel. This cement, when dry, may be polished with pulverized Venetian talc, until the surface has become perfectly smooth and shining.

In order to apply this Vitruvian cement to buildings, it is necessary that the parts to be covered should be first prepared with a rough ground or under coat, which may be done wich the following materials:—Take equal parts of the coarsest river sand, and the sand which is pulverized from mill-stones; mix them together, and add a third part of lime, which has been slacked for about three months; to these put as much water as will bring the composition into a paste; and when it is about to be used, add a fifth of very fine sifted lime, and apply it as common plaster.

If the cement is required to imitate the appearance of marble, that may be done by painting the veins like marble upon its surface, after the cement has been brought to a smooth surface by the trowel; and as soon as the paint has become dry the polishing process may be performed with the pulverized talc, as before described, when the work may be considered to be finished.

In order to increase the lustre of the polish, the inventor employed a sort of varnish, made by mixing two pints of water with four ounces of white soap, eight ounces of virgin wax, anp eight ounces of nitre, which are to be boiled together till the substances are quite dissolved. When the cement is perfectly dry, this varnish is to be sprinkled over the surface, and when uniformly spread, is to be rubbed well with a linen cloth, until the lustre is sufficiently brought up.

I am yours, respectfully,

J. Young.

SCULPTURE.

But few persons have a correct idea of the progress of a sculptor in his work; the general notion is, that he falls on a block of marble, and chisels it away until he makes it into a statue. But in reality the sculptor begins on much more ductile materials than marble. He first forms a model in clay, and this is entirely the work of his own hands; but before he begins, the statue is perfectly imagined; the figure, in visionary forms, is completely before him. When finished, a cast is taken from the model by the sculptor's assistants, which is dotted over with black points at regular intervals, to guide the workmen. From this model they begin to work, and having reduced the block of marble into form, and made it a rough-hewn statue, the sculptor himself resumes his labours. The exterior surface, as it were, is his to form and perfect, and it is at last polished with pumice stone. J. Y.

ACOUSTICS.

On the Reflections of Sonorous Undulations.

A SOUND is produced by a series of vibrations, which are appreciable to the ear as grave or acute, according to their velocity; sounds, in which no musical note can be distinguished, as the rustling of trees, the falling of a cataract, &c., being composed of innumerable heterogeneous vibrations, are termed noises. If, when a noise is heard, you approach an object proper for reflecting it, a detached sound will be heard, varying in acuteness, according to the distance between the reflecting body and the ear; being more grave as you recede from the reflector, and *vice versâ.*

To facilitate the observation, it is necessary to attend to several circumstances; no object of considerable extent, must intervene between the observer, and the source of sound or noise. The reflecting surface should be placed vertically, in order to enable the observer to approach to, or recede from it conveniently. A wall, a door, or a square of glass will satisfy this condition.

The distance of the ear from the reflector, may vary from 0, to six or eight feet; at a greater distance, the sound becomes too grave, to be easily distinguished. It is sufficient for the noise to continue long enough to permit the observation; the noise of a carriage upon the pavement, the beating of a drum, a fall of water, or the waves upon the sea-shore, are of sufficient intensity.

In the course of the experiments made by M. Savart (brother to M. Savart, known for his researches in acoustics), to determine the relation between the acuteness of the reflected sound, and the distance of the ear from the reflector, he found, that it was not only the acuteness which varied, but also the intensity; that there were certain distances, at which the sound could not be heard; and that these distances, measured upon the line of reflection, perpendicular to the reflector, were nearly equal.

He also found, that the source of sound or noise might be placed at different distances from the reflector, following a perpendicular line, without altering the distance of the points where the sound disappeared; and that they did not depend upon the nature of the sonorous body. The principal results of the experiments of M. Savart, are related by him, in the following terms:

"When sonorous undulations, proceeding from a vibrating body, strike upon a plain surface, and are afterwards reflected towards the point of their departure, there is formed, upon this line, by the meeting of the direct and reflected undulations, a kind of system of undulations having no progressive motion; that is to say, the ear, in passing through the different points of the straight line, between the sonorous body and the reflector, meets with nodes and expansions and intermediate points; and the intensity of the sound augments, in approaching towards a belly or expanded point of the system. This immobility of the different points of the undulations, enables us to mark the position of the axis of reflection; and it is found, that in measuring the length of the fixed undulations, they are equal to the direct ones; so that the produce of this length, by the number of vibrations of the sonorous body in a given time, is equal to the space passed over, by the direct undulations, in the same time. Nevertheless, the first undulation, that which is formed next to the reflecting surface, is an exception; it is much less than all the others."

The system of undulations which we have mentioned, is not the only one, produced by a vibrating body. There exists, at the same time, as many of these systems as there are harmonies; and each of them is subject to the same laws as the first. Hence it appears, that the interferences only take place with undulations of the same length. That which has been observed, respecting the small number of harmonies in a vibrating body, applies also to the simultaneous sounds which compose a noise. These facts led to the means of analysing a sound, of ascertaining its purity, and of discovering the causes of the various *timbres* (quality or voice), which characterize different sounds. These means apply equally to a noise. Plain surfaces have the property of increasing the intensity of all sounds: but it is necessary that the vibrating body be placed at a determined distance from the reflecting surface; which distance varies with the acuteness of the sound. Hence it follows, that if a body, producing noise be brought progressively towards a plain surface, each of the sounds of which it is composed, will be separately heard.

Method of Gilding Ivory.—Put the figure you intend to gild into a solution of sulphate of iron, and then dip it into a solution of nitro-muriate of gold; on withdrawing from the latter, it will be covered with a coat of metallic gold.

W. H. W.

ON CHEAP STOVES.

To the Editor of the Mechanic and Chemist.

Mr. Editor,—Being in want of a stove for heating a school-room, 28 feet by 23, and wishing to have one combining as many good qualities, with respect to economy of fuel, heat-generating power, and other such improvements as may hitherto have been made, I had finished a model of the Arnott stove after the Doctor's directions; and was about to superintend the construction of one. This however I have delayed, on my having seen, in some of the London papers, advertisements of other stoves; which, perhaps, mey be better. One of these is Nott's patent stove, which requires feeding only once every 6 hours. The other is White's patent air-stove; one of which is to be seen at the Adelaide-street exhibition. It is said to be a cheap and simple apparatus, which gives out a heat truly astonishing for the fuel consumed. On these stoves, especially on the last, I should feel much obliged for further information. Will you, Mr. Editor, or any of your readers, give me a description of them, or of any other stove which is likely to answer my purpose still better, by means of your valuable magazine; also stating what kind of fuel they require, and for how much they may be purchased? An early attention to this request is most earnestly solicited.

A Subscriber.

Jersey Jan. 8th 1839.

P.S.—You have hitherto, Mr. Editor, I believe, said nothing in your magazine about the Arnott, or, indeed, about any stove except Joyce's. Would not an article on heat-generating contrivances, a subject so intimately connected with the comfort of man especially in this season, be highly acceptable to all your readers?

[Dr. Arnott's stove was described in a former number of "the Mechanic." We are not aware of any material improvement upon the common German stoves, used in most places on the continent; they are usually made of very thick stone; and the flue is conducted several times round the body of the stove before the exit, which is a metal tube. When the flame and smoke have ceased, the exit is stopped, to prevent the escape of the warm air consumed within the stove. Wood is a more convenient combustible than coal, for these stoves.—Ed.]

Artesian Wells.—The boring of the artesian well at the Abattoir de Crenelle, has now attained the depth of 1,400 feet, but no water has yet been found.

EXTRAORDINARY CHEMICAL AND OPTICAL DISCOVERY.

At the last sitting of the Academy of Sciences, M. Arago announced one of the most important discoveries, in the fine arts, that have distinguished the present century; the author of which has already acquired universal reputation by his miraculous diorama—M. Daguerre. It is well known that certain chemical substances, such as chlorate of silver, have the property of changing their colour by the mere contact of light; and it is by a combination of this nature, that M. Daguerre has succeeded in fixing upon paper prepared with it, the rays that are directed on the table of the camera obscura, and rendered the optical tableau permanent. The exact representation of whatever objects this instrument is directed to is, as everybody is aware, thrown down, with vivid colours, upon the white table prepared to receive them, and the rays of light that are thus reflected, have the power of acting, in the way above alluded to, upon chlorate of silver, or certain preparations of it. In this manner, an exact representation, in light and shade, of whatever object may be wished to be viewed, is obtained with the accuracy of nature herself; and it is stated to have all the softness of a fine aquatint engraving. M. Daguerre had made this discovery some years ago, but he had not then succeeded in making the alteration of colour permanent on the chemical substance. This main desideratum he has now accomplished; and, in this manner, has been able, among other instances, to make a permanent chemical representation of the Louvre, taken from the Pont des Arts. M. Arago, in commenting upon this most extraordinary discovrey, observed, that a patent would be, by no means, able to preserve the rights of the discoverer sufficiently to reward him for his efforts; and he therefore urged the propriety of an application being made to the legislature, for a grant of public money, as a recompence. M. Biot, on the same occasion, compared M. Daguerre's discovery to the retina of the eye, the objects being represented on one and the other surface with equal accuracy.

Power of the Wind—A gentleman from Cheshire states, that such was the severity of the late storm, that his windows were covered with salt, and that his woods were white as with hoar frost; which, on tasting, and examination with a microscope, he found to originate in minute crystals of salt; the distance from the sea being 30 miles.

STEAM CARRIAGES ON COMMON ROADS.

To the Editor of the Mechanic and Chemist.

Sir,—Knowing the interest you have taken in the application of steam carriages to common roads, it has induced me to send you the following paper, for the insertion of which in your useful magazine I shall be much obliged.

The effects of Railroads and the benefits of Common Road Locomotion.

It is now more than seven years since Mr. W. Hancock commenced running his carriages on the different roads in the neighbourhood of the Metropolis, and he has proved beyond the least doubt the practibility of his system, which many had pronounced to be fallacious. About the same time there were many competitors in the field of the names of Summers, Ogle, Gurney, Dance, and Anderson, all of whom, except the last, have dropped off one by one, leaving Mr. W. Hancock and the worthy baronet alone to fight or fall in the good work in which they are engaged. Of the last mentioned gentleman, much has of late been said on account of his triumph in rendering the monster steam perfectly tractable, while at the same time he had endowed him with more than gigantic power. His engine has been expected in London for the last three months, and its non-arrival has induced me, Sir, to bring the subject before your readers.

The London and Birmigham Company have expended upwards of six millions in the formation of their line, which, now it is completed, has ransacked every stage of its passengers, and the famous Liverpool road on which passed 100 coaches daily, cannot now boast of a dozen. It is to such facts as these that I wish to call the attention of the public generally; and, through the medium of your magazine, to ask if the working classes of this country are to suffer want and starvation merely because the London and Birmingham Company are to monopolize all the traffic of the manufacturing districts, upon the carriage, &c., of which great numbers depended for support.

And here allow me to suggest two or three things for overcoming the difficulties that are said to be insurmountable, in bringing into practice this hitherto unbounded power. First, I would propose that drag-engines be used, as by this means a greater power can be called into action, and at a proportionate less cost than by a number of coaches with engines on the same carriage frame as themselves. Again, the drag-engines could be made sufficiently powerful to draw after them a train of six or seven carriages or waggons, and should the capabilities of these trains to pass other vehicles and turn curvatures in the road be doubted by any of your readers, I will shortly send you a plan of an engine and carriages attached in such a manner, that every carriage shall of itself be able to turn the corners, independant of the motion of the engine. Second, I propose that the engines take the trains to no further distance than ten or twelve miles, and prcceed exactly in the same manner as the coaches are horsed; thus if one engine were to take the train to Barnet, and another being there in readiness to convey it to St. Albans, and so on to proceed throughout the journey, it is obvious, were an accident to happen, another engine could be despatched to meet the train and forward it on its journey. Hoping, Sir, to resume the subject shortly, and that these hints may not prove useless,

I beg to remain, your's &c.,

T. S. Browne.

[We insert this letter, although we do not exactly agree with our correspondent. It does not appear practicable to turn a corner, with seven carriages attached to a drag, without much inconvenience; and if some have suffered by a portion of the traffic being transferred from ordinary roads to railroads, it must also be considered that a new industry has been created by the latter. It is, however, fair that the interests of every class should be duly considered, and, if postible, protected.—Ed.]

Easy Method of Breaking Glass in any Direction.—Dip a piece of worsted thread into spirit of turpentine, and put it round the glass in the direction you require it to be broken; then set fire to the thread, and the glass will break in the direction of the thread; or apply a red hot small wire round the glass, and if it does not crack immediately, throw cold water on it, and the desired effect will be accomplished. This is a very useful method for Chemists; for broken glasses may, by this means, be rendered serviceable in the laboratory. The explanation of this is as follows:—By the application of heat to glass, as to other bodies, the part heated expands; and as glass transmits heat but slowly, the parts to which heat is applied expand faster than the other parts, and thus separate from them, or the glass cracks.

MEDICINAL PROPERTIES OF CAMPHOR.

The following has appeared in the French journal *L'Expérience.* The author, M. Raspail, desires all possible publicity to be given to it:—

1st. A small box with a double bottom is to contain in one compartment, camphor reduced to an impalpable powder, and in the other, small cigars of camphor; this will be a portable *pharmacie*, or medicine chest for a variety of cases. The cigars are small tubes of straw or quill, in which are introduced small grains of camphor enclosed by paper plugs. They are used by merely inhaling the cold air which is drawn through them in the manner of smoking. The powder is taken in the manner of snuff; it is scarcely at all sternutatory.

2nd. A *compresse* dipped in alcohol saturated with camphor, with an impermeable covering to prevent the evaporation of camphor and alcohol, is so applied that the suffering part is constantly enveloped in an atmosphere of camphor.

3rd. In all affections of the lungs, even in consumption, the patient should constantly have a camphor cigar in his mouth, and take a pinch of the powder from time to time; the accesses will be less frequent, and less intense, if they do not entirely disappear. The pain occasioned by pulmonary adherence, commonly called "a stitch in the side," is dissipated almost immediately by the use of the compresse, and the cigars.

After enumerating a variety of cases in which camphor may be advantageously employed, M. Raspail affirms that horses affected with the glanders, may be cured by causing them to inhale the powder, and washing the nasal orifices with the camphorated alcohol. Pains in the ears and eyes are cured by the introduction of the powder into the external tube of the ear. A piece of camphor introduced into the hollow of a decayed tooth, will appease the pain in a few seconds, and often arrest the progress of decay. Too much importance should not be attached to the repugnance which many persons feel at the odour of camphor; this repugnance is often imaginary and conventional; but in all cases the unpleasant effect will cease in a few minutes. The impressions of our senses lose their acuteness by constant and uniform action.

TO BRONZE OR BROWN GUN BARRELS, ETC.

Take nitric acid two ounces, sweet spirits of nitre two ounces, alcohol one ounce, sulphate of copper (blue vitriol) two ounces, tincture of steel one ounce. These ingredients are to be mixed, the sulphate of copper having been previously dissolved in a sufficient quantity of water to make with the other ingredients one quart of mixture. Before commencing the operation of bronzing a gun barrel, it is necessary that it be well cleansed from all grease and dirt; also that the muzzle and touch-hole be well plugged with wood to prevent the mixture injuring the inside. The composition is then to be applied with a clean sponge or linen rag, taking care that every part of the article be covered with the mixture, it is then to be exposed to the air for twenty-four hours, after which the barrel must be rubbed with a hard brush to remove the oxide from the surface.

This must be performed a second or third time if requisite, by which the barrel will be of a perfectly brown colour; it must then be carefully rubbed and wiped, and immersed in boiling water, in which a quantity of alkaline matter has been dissolved, in order that the action of the acid may be destroyed, and the impregnation of the water by the acid be neutralized. The barrel when taken from the water must, after being rendered perfectly dry, be rubbed smooth with a burnisher of hardwood, and then heated to about the temperature of boiling water; it then will be ready to receive a varnish made of the following materials:—Alcohol one quart, dragon's blood, pulverized, three drachms, shellac three ounces. The varnish when perfectly dry on the barrel, must be rubbed with a burnisher to give it a glossy appearance.—*Register of Arts, &c.*

A Beautiful Ornament for Glass or Slate.—Spread on a plate of glass a few drops of nitrate of silver previously diluted with double its quantity of rain water; place at the bottom of it, and in contact with the fluid, a zinc or copper wire, bent in any form you please, and let the whole remain undisturbed in a horizontal position, in a few hours a beautiful crystallization of metallic silver will arrange itself around the wire, and continue to increase until the whole of the fluid has been acted on by the wire.

W. H. W.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, Jan. 23, W. Sturgeon, Esq., on Galvanism.—Friday, 25, S. Logan, Esq., on Phrenology.
At half-past eight precisely.

Tower Street Mutual Instruction Society.—Monday, Jan. 21, Mr. Thorne, on the Electrical Theory, Economy of Nature, Laws of Electricity, Use of Comets, Proofs from Geology.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, Jan. 22, Dr. R. D. Thomson, on the Geology of Great Britain. At half-past eight.

Poplar Institution for Mutual Instruction, and the Promotion of Literature, Science, &c., East India Road.—Tuesday, Jan. 22, Dr. Mitchell. History of Turkey.—Friday, 25, Discussion.

ANSWERS TO QUERIES.

"A. B." may see a lathe and complete set of tools by applying at No. 1, Eve Place. St. Pancras Old Church. J. R.

Sir,—In answer to your correspondent "A. B." in No. 121, I beg to inform him that the best work on turning is by Ibbotson. Also, that I have an excellent 5½ inch lathe, iron beds, mandril frame, poppits, &c., to dispose of. C. Lannder.
34, Queen St., New Cut, Lambeth.

To distinguish Steel from Iron.—The principal characters by which steel may be distinguished from iron are as follows:—1. After being polished, steel appears of a whiter light grey hue, without the blue cast exhibited by iron; it also takes a higher polish. 2. The hardest steel, when not annealed, appears granulated, but dull, and without shining fibres. 3. When steeped in acids, the harder the steel is, of a darker hue is its surface. 4. Steel is not so much inclined to rust as iron. 5. In general steel has a greater specific gravity than iron. 6. By being hardened and wrought, it may be rendered much more elastic than iron. 7. It is not attracted so strongly by the magnet as soft iron: it likewise acquires magnetic properties more slowly, but retains them longer. 8. Steel is ignited sooner, and fuses with a less degree of heat than malleable iron, which can scarcely be made to fuse without the addition of powdered charcoal, by which it is converted into steel, and afterwards into crude iron. 9. Polished steel is sooner tinged by heat, and that with higher colours than iron. 10. In a calcining heat it suffers less loss by burning than soft iron does in the same heat and the same time; in calcination a light blue flame hovers over the steel, either with or without a sulphurous odour. 11. The scales of steel are harder and sharper than those of iron, and consequently more fit for polishing with. 12. In a white heat, when exposed to the blast of the bellows among the coals, it begins to sweat, wet, or melt, partly with light-coloured and bright, and partly with red sparkles, but less cracking than those of iron; in a melting heat, too, it consumes faster. 13. In the vitriolic, nitrous, and other acids, steel is violently attacked, but is longer in dissolving than iron. After maceration, according as it is softer or harder, it appears of a lighter or darker gray colour, while iron, on the other hand, is white. P. Truman.

To make Chinese Sheet Lead.—The operation is carried on by two men; one is seated on the floor, with a large flat stone before him, and with a moveable one at his side. His fellow-workman stands beside him with a crucible filled with melted lead, and having poured a certain quantity upon the stone, the other lifts the moveable stone, and dashing it on the fluid lead, presses it out into a flat and thin plate, which he instantly moves from the stone. A second quantity of lead is poured in a similar manner, and a similar plate formed, the process being carried on with singular rapidity. The rough edges of the plates are then cut off, and they are soldered together for use. P. T.

To make Queen's Metal.—Melt together four pounds and a half of tin, half a pound of bismuth, half a pound of antimony, and half a pound of lead. A very excellent alloy will be formed by using these proportions, and will be found to retain its brilliancy to the last. P. T.

To make a Powder for Gilding on Silver.—Into a solution of nitro-muriate of gold (which is made by dissolving gold leaves in nitro-muriatic acid, till the acid refuses to dissolve more) dip some linen rags: after letting them dry, set fire to them, and keep the charcoal that remains, and reduce it to powder. To use this powder take a good sound cork, slightly moisten it with water, and dipping it into the powder, rub forcibly on the silver, which may afterwards be burnished. W. H. W.

QUERIES.

Sir,—I wish to know where I can purchase a portable alarum, and at the lowest price; such as will wake a person in the morning. S S. W.

"A Constant Reader" wishes for further information respecting the new steam-vessel apparatus noticed in No. 121.

"J. E." wishes to know upon what principle the velocipede, exhibiting at the Polytechnic Institution, is constructed. Also the best means of heating an adjoining apartment, by means of a pipe or other apparatus, passing from the back of the fire in a parlour, kitchen, or other place.

Sir,—Perhaps some of your intelligent chemical correspondents will oblige, by informing me in what way I can destroy the powerful smell of poppy oil, without destroying its properties, either by some scent more agreeable to the senses than itself, or by doing away with the smell altogether. The latter I should prefer if it could be accomplished. C.

"A Constant Reader" wishes to know what discoveries have been made by Sir John Herschel at the Cape. Also, whether Sir John Herschel's forty-feet telescope was ever exhibited to the public. Where he can purchase Blunt's Map and Chart of the Moon; and where he can purchase a small oxy-hydrogen microscope.

TO CORRESPONDENTS.

E. G—y. *The Index, &c. of Vol. III. being now published, will answer his three first queries. The Supplements will, as heretofore, form a part of the work, and be sold at the same price as the other Numbers.*

Astron. *The exact length of the year, or one entire revolution of the earth about the sun, is* 365 *days,* 6 *hours,* 48 *minutes,* 49 *seconds. The year, as computed in the Calendar, exceeds the true year, being there considered as* 365 *days* 6 *hours. The new style was decreed by Pope Gregory XIII. in the year* 1582. *It was also agreed, that of every* 400 *years, the* 100*th,* 200*th, and* 300*th. should not be made leap years, but contain only* 365 *days. The years in which the supplementary day is omitted are* 1700, 1800, 1900, 2100, 2200, 2300, 2500, *and so on, till posterity shall deem it advisable to seek for greater precision. In about* 3668 *years the Calendar will differ from the true year, by this computation, only one day.*

Philomathes. *We thank him for his paper on algebra. but must decline inserting it. It is copied from Bonnycastle, and would not be completed in less than five years, were we to continue it. It would be no great gratification to our readers to have our columns choaked up with scraps of school books, which may be purchased at an old bookstall for sixpence.*

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THE

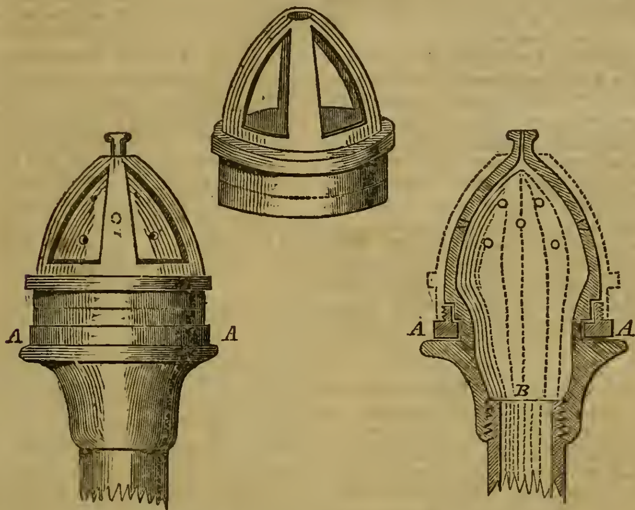
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. IV. NEW SERIES. | SATURDAY, JAN. 26, 1839. (PRICE ONE PENNY.) | No. CXXV. OLD SERIES.

IMPROVED FOUNTAIN JET.

FIG. I.



GEOMETRICAL PROBLEM.

FIG. II.

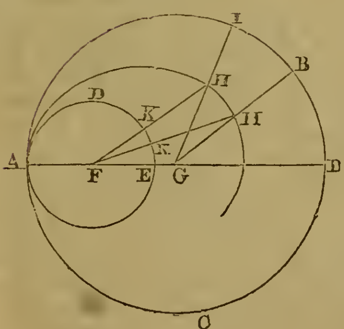
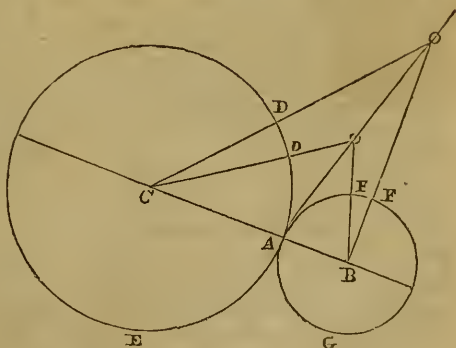


FIG III.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

FOUNTAIN JET.

(See fig. 1 front page.)

To the Editor of the Mechanic and Chemist.

Sir,—I send you a drawing and description of an improvement in fountain jets, which I have effected; the object of which is, to make one jet perform the purposes of two or three different jets, by playing three different ways. This plan is very simple, saves expense, and is easily accomplished by hand.

Over the jet now in use I propose to put a cap, having four triangular holes, and fitting exactly. At the bottom of this cap there is a narrow female screw, which screws on a ring having a male screw, a section of which ring is shown at A A in fig. 3, and an elevation of it at A A in fig. 2. This ring (as can be seen) turns round and round without coming off, and when the cap is screwed on it, they form one compact piece, and can be turned round at pleasure without coming off, being kept on by the projections close above the ring. Fig. 1 is the outer cap, unconnected with anything else. The triangular holes and one in the top to admit the perpendicular jet can be seen, and the depth of the female screw is dotted. Fig. 2 is an outside view of the jet, with the cap on, and will more clearly explain the object of the improvement.

In the drawing two orifices are exposed in each triangular hole, so that there are eight orifices exposed all round, as well as one perpendicular jet. If the outer cap be turned a little, so that the partitions between the triangles shall cover the eight orifices, then one orifice will be exposed in each triangle, and we shall have four orifices exposed all round, besides the perpendicular jet.

Again; if the cap be taken completely off, there will be twelve orifices and one perpendicular jet exposed. So that it appears, by this contrivance, simply by turning the top by the hand, we obtain three distinct sorts of play, which could not before have been effected, unless by three separate jets.

Fig. III. is a section of the whole jet, with the ring at A A in the section, and the outer cap dotted. From this it is seen that the whole can be removed by a screw, as at B.

Hoping that I have rendered the contrivance sufficiently plain, and that it will find a place in your useful journal,

I remain your most obedient servant,

W.

GEOMETRICAL PROBLEM.

(See figs. 2 & 3 front page.)

To the Editor of the Mechanic and Chemist.

Sir,—You will oblige me by inserting the following answer to Mr. Whitcombe's query in No. 111.

Let A D E be a circle, touching, and within another, A B C. Let A be the point of contact, and F and G the two centres; then will A, F, and G, be in the same straight line; and because the sum of two lines, drawn from the two centres to meet at any point in the required curve, is invariable, for H I = K,* therefore the required curve will be elliptic, F and G being the foci.

Again. Let the larger circle, A D E, touch the smaller, A F G, at A; then will the centres, C and B, be in the same straight line as A, and become the difference of two lines drawn from the two centres, A and B, to meet at any point in the required curve is invariable; for F O = D O, therefore the curve is hyperbolic, and C and B the foci. Yours, &c.

Worcester. John Burlison.

* In approaching towards the point A, the increment at G H is equal to the decrement at I H = dec. E H; G I and F K are invariable; therefore G I — H I + F K + K H must be invariable.—Ed.

PHRENOLOGY.

To the Editor of the Mechanic and Chemist.

Sir,—I was rather surprised to see, in a few numbers back, a very hasty conclusion drawn from a single case, by no less persons than M. M. Bouilland and Martin Solon. I was much surprised that they should balance one isolated instance against thousands which have lent their evidence to the truth of the science; and that they should, from this one case, draw the great conclusion, that "the localizing phrenology of Gall is a chimera," &c. But my object now is not to reflect, but to attempt, at least, to disprove, not the statement, but the conclusion drawn. I begin at the last organ mentioned, viz. "He had poisoned his comrade for the purpose of obtaining forty francs; and neither the organ of acquisitiveness, nor that of destructiveness, were in the least prominent." Now we should not look only at the fact of his having committed a murder, but we must ask why he committed it? what were the incentives? and was he naturally destructive? Spurzeim says (and his localizing of the organs was the same as that of Dr. Gall), "this organ has done much harm to the science, inasmuch as phrenologists themselves have called it the organ of murder, *which it is*

not, being only a natural propensity to procure or kill for food, and put away evils." M. Rochaux continues, "he poisoned him for forty francs." But why did he want these? Was it merely a love of getting, or from want? If he did it from want, or poverty, or any motive besides a love of hoarding or amassing, the non-appearance of the organ of acquisitiveness would be perfectly natural. It is very probable he had secretiveness very largely developed. "He was a great gormandiser, yet the organ of alimentiveness was scarcely perceptible." To this I answer, neither Gall nor Spurzeim has established this organ. But supposing it were established, it is not the organ of gormandising or gluttony, but of epicurianism; therefore this would prove nothing.

I remain your's, respectfully,

FORMATOR.

ON THE MECHANICAL POWERS.

NO. IV.

WHEN a lever is applied to raise a weight, or overcome a resistance, the space through which it acts at any one time is small, and the work must be accomplished by a succession of short and intermitting efforts. For instance, after the weight has been raised, the lever must return again to its first position to repeat the action. During this return, the motion of the weight is suspended, and it will fall downwards unless some provision be made to sustain it. The common lever is, therefore, only used in cases where weights are required to be raised through small spaces. But where a continuous motion is to be produced, as in weighing the anchor of a vessel, some means must be adopted to remove the intermitting action of the lever, and render it continual. The various forms given to the lever with a view to accomplish this, are usually called the *wheel* and *axle*. The moment of the power is found by multiplying it by the radius of a wheel, and the moment of the weight, by multiplying it by the radius of its axle. If these moments be equal, the machine will be in equilibrium. Whence it appears, that the power of the machine is expressed by the proportion which the radius of the wheel bears to the radius of the axle; or, of the diameter of the wheel to the diameter of the axle. It is evident, that as the power descends continually, and the rope is uncoiled from the wheel, the weight will be raised continually, the rope by which it is suspended being at the same time coiled upon the axle. In the elevation of the weight, a quantity of power is expended equal to that which would be necessary to elevate the weight, if the power were immediately applied to it, without the intervention of any machine. In one revolution of the machine, the length of rope uncoiled from the wheel is equal to the circumference of the wheel, and through this space the power must therefore move. At the same time, the length of rope coiled upon the axle is equal to the circumference of the axle, and through this space the weight must be raised. The spaces, therefore, through which the power and weight move in the same time, are in the proportion of the circumference of the wheel and axle; but these circumferences are in the same proportion as their diameters. Therefore the velocity of the power will bear to the velocity of the weight, the same proportion as the diameter of the wheel bears to the diameter of the axle; or, what is the same thing, as the weight bears to the power, numerous forms of the wheel and axle, the weight or resistance is applied by a rope coiled upon the axle. The circumference of a wheel sometimes carries projecting pins, to which the hand is applied to turn the machine. An instance of this occurs in the wheel used in the steerage of a vessel. The axle is sometimes placed in a vertical position, the wheel or levers being moved horizontally. The capstain is an example of this. In some cases the wheel is turned by the weight of animals placed at its circumference, who move forward as fast as the wheel descends. The treadmill is an instance of this. In the paddle-wheel of a steam-boat, the power is the resistance which the water offers to the motion of the paddle boards. In most cases in which the wheel and axle is used, the action of the power is liable to occasional suspence, in which case some contrivance is necessary to prevent the recoil of the weight. A ratchet-wheel is provided for this purpose, which is a contrivance that permits the wheel to turn in one direction; but a catch which falls between the teeth of a fixed wheel prevents its motion in the other direction. The power of the wheel and axle being expressed by the number of times the diameter of the axle is contained in that of the wheel, there are obviously only two ways by which this power can be increased, namely, either by increasing the diameter of the wheel, or diminishing that of the axle. In cases where great power is required, each of these methods is attended with difficulty and practical inconvenience. To combine the requisite

strength with moderate dimensions and great power, is, therefore, impracticable in the common form of the wheel and axle. This has, however, been accomplished by giving different thicknesses to different parts of the axle, and carrying a rope, which is coiled on the thinner part, through a wheel attached to the weight, and coiling it in the opposite direction on the thickest part. When great power is required, wheels and axles may be combined in a manner analogous to a compound system of levers. In this case the power acts on the circumference of the first wheel, and its effect is transmitted to the circumference of the first axle. That circumference is placed in connection with the circumference of the second wheel, and the effect is thereby transmitted to the circumference of the second axle, and so on. The power of such a combination of wheels and axles will be found by multiplying together the powers of the several wheels of which it is composed. The manner in which the circumferences of the axles act upon the circumferences of the wheels in composed wheel-work, is various. Sometimes a strap or cord is applied to a groove in the circumference of the axle, and carried round a similar groove in the circumference of the succeeding wheel. One of the great advantages gained by transmitting motion between wheels and axles by straps or cords is, that the wheel and axle may be placed at any distance from each other which may be found convenient, and may be made to turn either in the same or contrary directions.

Examples illustrative of the Wheel and Axle.

Example 1. A power equal to 30 lbs. is applied to the winch of a crane whose length is fifteen inches, the pinion contains 10 teeth, the wheel 120, and the barrel is 9 inches diameter. Required the weight raised?

$15 \times 2 \times 3 \cdot 1416 = 94 \cdot 248$ circumference of the circle described by the winch or handle; $120 \div 10 = 12$ revolutions of the pinion for one of the wheel, and $3 \cdot 1446 \times 9 = 28 \cdot 2744$ the barrel's circumference; then $\frac{94 \cdot 248 \times 1230}{28 \cdot 2744} = 1200$ lbs. raised by this crane.

Example 2. What power is requisite to raise 42 tons 60 feet high in ten minutes, the velocity of the power being 20 feet per minute?

$60 \div 10 = 6$ and $\frac{42 \times 6}{20} = 16.8$ tons of power.

A. D. M.

REVIEW.

Tales about America and Australia. By PETER PARLEY.

HERE is Peter Parley again; his visits are frequent, it is true, but the information he brings our juvenile friends is so good, and the manner in which he communicates it so truly agreeable, that he cannot come too often. We therefore join the universal cry of, "*All hail, Peter Parley!*"

THE GREAT WESTERN RAILWAY.

WHEN opposite opinions excite angry feelings, and contending interests create hostile parties, it becomes extremely difficult to argue, or even to think upon the subject of contention, with perfect impartiality. In the reports of Mr. Wood and Mr. Hawkshaw, who were appointed by the Directors of the Great Western Railway Company, to examine and report upon the merits of the mode of construction adopted by Mr. Brunel, this difficulty does not appear to be entirely overcome; we do not affirm that either of those gentlemen has deliberately advocated the cause of the opponents of Mr. Brunel, but a careful perusal of the two documents, inclines us to believe that they have both, especially the latter, expatiated more elaborately and more earnestly, upon the disadvantages, than they have done upon the advantages of Mr. Brunel's plans. Whenever such tendency is observed, every assertion, every conclusion, and every opinion, should be examined with jealous scrutiny, before they are admitted as established facts, or even as probable conjectures.

These reports are too voluminous for publication in this work, but we will endeavour to present to our readers such extracts and comments thereon, as will exhibit the principal features and merits of the discussion.

The most plausible objection to the increased gauge (seven feet instead of four feet eight inches and a half), is, that it will prevent the connexion of other railways of a different gauge with this line. Mr. Hawkshaw says, " Under the superintendence of men who were earliest connected with the Liverpool and Manchester Railway, and with railways even prior to that, it has been constructed on a gauge of four feet eight inches and a half. They had had more experience than others in railway matters; and their continuing the same dimensions as to width of way, proves that they had found no occasion for alter-

ing it. Moreover it is indispensably true, that they who have had the most experience, and have been brought most into contact with railways, see the least occasion for alteration as to width, and are the most satisfied with the present gauge.

"In addition to this main truth, another line crossing it at right angles, and of which the Liverpool and Manchester, and the Leeds and Selby Railways form a part, and which will connect the eastern with the western seas, is already constructed, or in progress, to a similar gauge; and other lines of great extent, some of them surrounding and piercing into the district into which your railway goes, are also formed, or are rapidly forming, to the 4 feet 8½ inches guage; and it will not be too much, perhaps, to say, that three-fourths of England is already being traversed by railways to the narrower gauge.

"It follows, then, that any company deviating from this gauge, will be isolating themselves to a certain extent; if not as regards their main line, yet as regards their branches; if not as regards their direct traffic, yet certainly as regards their collateral traffic."

In reply, Mr. Brunel says, "This is undoubtedly an inconvenience; it amounts to a prohibition to almost any railway running northwards from London, as they must all more or less depend for their supply upon other lines or districts where railways already exist, and with which they must hope to be connected. In such cases there is no alternative.

"The Great Western Railway, however, broke ground in an entirely new district, in which railways were unknown. At present it commands this district, and has already sent forth branches which embrace nearly all that can belong to it; and it will be the fault of the Company if it does not effectually and permanently secure to itself the whole trade of this portion of England, with that of South Wales and the south of Ireland; not by a forced monopoly, which could never long resist the wants of the public, but by such attention to these wants as shall render any competition unnecessary and hopeless. Such is the position of the Great Western Railway. It could have no connexion with any other of the main lines, and the principal branches likely to be made, were well considered, and almost formed part of the original plan; nor can these be dependent upon any other existing lines for the traffic which they will bring to the main trunk. At the London extremity, from the moment the junction, as originally projected, with the London and Birmingham Railway, was obliged to be given up, there existed no possibility of a connexion with any other line. London will always be the terminus of those main lines now established, and which approach it from distant quarters, and the traffic of each will cease at this point; and unless when two such lines unite to form a common entrance into town, they will have no connexion with each other at this extremity. The Great Western was, therefore free to adopt its own dimensions, and none of the difficulties which would entirely prevent such a course in the north of England had any existence in the west; and, consequently, all the general arguments advanced, and the comparisons made, on the supposition of such difficulties occurring,—all excellent in case they did,—are totally inapplicable to the Great Western Railway, to which they have no reference whatever."

The opinions of two of the largest manufacturers of locomotives in the kingdom, Mr. Edward Bury, and Messrs. Robert Stephenson and Co., are in favour of an increased width of gauge, but they think seven feet a greater width than is necessary.

The advantages of a wide gauge are manifest; greater power is obtained, and consequently greater speed, or a greater weight is drawn than could be done at the same speed, with an engine of lesser dimensions; also the angular motion produced by any inequality in the line of rail, will be diminished by the two opposite points of support being further apart. The wide gauge admits of the body of the carriage being placed within the wheels, so that their diameters may be increased without raising the centre of gravity of the carriage. By this means friction is evidently reduced, though its advantage is contested in the Report.

(To be continued.)

ARTESIAN WELL.

In the yard of the *Abattoirs* (slaughter-houses) at the barrier of Grenelle, the city of Paris is causing an Artesian well to be sunk; they have already pierced to the enormous depth of 1400 feet. It is three times the height of the steeple of Strasburgh church, which is the highest in France. The soil of Paris was never before penetrated to so great a depth, and yet no water has appeared. It is intended to pierce to the depth of 1500 feet.

CRIBBAGE.

To the Editor of the Mechanic and Chemist.

Sir,—I should feel obliged by the insertion of the following, which was, by mistake, omitted in my calculation, No. 122.

Q. E. D.

$6+3+3+3 \,.\, 4\times4=$	16
$6+3+3+2+1 \,.\, 4\times6\times4\times4=$	384
$6+3+3+1+1+1 \,.\, 4\times6\times4=$	96
$6+3+2+2+2 \,.\, 4\times4\times4=$	64
$6+3+2+2+1+1 \,.\, 4\times4+6+6=$	576
$6+3+2+1+1+1+1 \,.\, 4\times4\times4\times1=$	64
$6+2+2+2+2+1 \,.\, 4\times1\times4 \,.=$	16
$6+2+2+2+1+1+1 \,.\, 4\times4\times4=$	64
$5+5+5 \,.\, 4=$	4
$5+5+4+1 \,.\, 6\times4\times4=$	96
$5+5+3+2 \,.\, 6\times4\times4=$	96
$5+5+3+1+1 \,.\, 6\times4\times6=$	144
$5+5+2+2+1 \,.\, 6\times6\times4=$	144
$5+5+2+2+1+1+1 \,.\, 6\times6\times4=$	96
$5+4+4+2 \,.\, 4\times6\times4=$	96
$5+4+4+1+1 \,.\, 4\times6\times6=$	144
$5+4+3+3 \,.\, 4\times4\times6=$	96
$5+4+3+2+1 \,.\, 4\times4\times4\times4\times4=$	1024
$5+4+3+1+1+1 \,.\, 4\times4\times4\times4=$	256
$5+4+2+2+2 \,.\, 4\times4\times4=$	64
$5+4+2+2+1+1 \,.\, 4\times4\times6\times6=$	576
$5+4+2+1+1+1+1 \,.\, 4\times4\times4\times1=$	64
$5+3+3+3+1 \,.\, 4\times4\times4=$	64
$5+3+3+2+2 \,.\, 4\times6\times6=$	144
$5+3+3+2+1+1 \,.\, 4\times6\times4\times6=$	576
$5+3+3+1+1+1+1 \,.\, 4\times6\times1=$	24
$5+3+2+2+2+1 \,.\, 4\times4\times4\times4=$	256
$5+3+2+2+1+1+1 \,.\, 4\times4\times6\times4=$	384
$5+2+2+2+2+1+1 \,.\, 4\times1\times6=$	24
$5+2+2+2+1+1+1+1 \,.\, 4\times4\times4=$	64
$4+4+4+3 \,.\, 4\times6\times4=$	96
$4+4+4+2+1 \,.\, 4\times4\times4=$	64
$4+4+4+1+1+1 \,.\, 4\times4=$	16
$4+4+3+3+1 \,.\, 6\times6\times4=$	144
$4+4+3+2+2 \,.\, 6\times4\times6=$	144
$4+4+3+2+1+1 \,.\, 6\times4\times4\times6=$	576
$4+4+3+1+1+1+1 \,.\, 6\times4\times1=$	24
$4+4+2+2+2+1 \,.\, 6\times4\times4=$	96
$4+4+2+2+1+1+1 \,.\, 6\times6\times4=$	144
	6920

The total amount is 2,189,690,156.

GAS PRODUCED BY THE DECOMPOSITION OF WATER.

That water is composed of two elements of combustion, oxygen and hydrogen, has long been known; and practical methods have been sought to effect its decomposition, in order to apply those elements, or at least one of them, to the production of light. There are various methods of obtaining the hydrogen of water, by easy processes; but its flame, in an uncombined state, is unfit for the purpose of lighting.

Recent experiments have however revived the hope, that water will ultimately supersede the use of coal, in the production of gas.

Water gas, produced by the process of M. Selligue, is now employed at Antwerp; it has been tried at Belleville; but has since been abandoned at this latter place.

M. Selligue's process consists in passing a current of steam over red-hot coke. The water is converted into carbonated hydrogen; and this light gas is mixed with the denser gas, obtained from resin. Some chemists pretend that water so treated, forms the oxide of carbon; now this gas, which burns with a blue flame, has little power of lighting; the mixture therefore may augment the quantity of gas; but it is at the expense of the quality.

At the meeting of the Royal Academy, at Paris, Jan. 9th, M. Selligue said, that towards the end of 1835 and 1836, in the manufactory of M. M. Chartron, at Saint Vallier, he made all the experiments which M. Longchamp claimed as original. "I have proved," said M. Selligue, "by experiments made upon 300 burners, in that establishment, that by adding water to carburant matters, which are employed for making gas, a much greater quantity of gas is obtained; and no deposit of carbon or of oil, is produced."

The apparatus employed by M. Selligue, consists of vertical iron tubes, with iron chains suspended within, occupying three-fourths of the cylinder of decomposition.

It would undoubtedly be a great achievment, if hydrogen, disengaged from water, could be rendered fit for lighting, without the consumption of expensive materials; but the process must be economical, and the quality good, before it can compete with the coal gas. When the great value of the residue of coal gas is taken into consideration, it will appear that the expense of its manufacture, is, by no means, commensurate with the high charges of some of the companies. The public have perhaps more to hope from the abolition of monopoly, and the consequent reform in the administration of the great companies, than from all the speculations of chemists; who, nevertheless, seem determined to persevere till they have literally set the Thames on fire.

ELECTRO-MAGNETISM.

To the Editor of the Mechanic and Chemist.

Sir,—Being a constant reader of your valuable little work, and being desirous of communicating anything that may be interesting, I send you a few remarks on the sustaining battery used for experiments on electro-magnetism. It is well known that the bladder that is used to separate the liquids, is attended with several inconveniences; to remedy these, earthenware pots have been constructed; but these are too expensive to come into constant use; and their structure renders them so liable to fracture by the slightest accident. It occurred to me, more than once, that common unglazed earthenware might answer the purpose as well: I accordingly took a common flower-pot, after having stopped the bottom up with a cork, and placed it in a gallipot; the battery was then charged in the usual manner with a solution of common salt and sulphate of copper; the zinc being outside and the copper in. When connected with a galvanometer, the needle began to oscillate; till at length it came to rest at an angle of 20°. Upon reversing the poles of battery, the contrary effect took place: thus proving that the electrical effect took place through the common earthenware of which the flower-pots are constructed. I have not the opportunity to enter farther into inquiry upon this subject; but if it may prove of sufficient interest to some of your readers to investigate the same, I shall be happy to hear of the result, through the pages of this work.

I remain Sir, your's

Jan. 10th, 1839. C. White.

To Make Transparent Soap.—Any person may make this soap, by putting, in a thin glass-phial, the half of a cake of Windsor soap-shavings; fill it with one half of alcohol, and put it near the fire, until the soap is dissolved. This mixture, placed in a mould to cool, produces the transparent soap.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, Jan. 30, W. Sturgeon, Esq., on Galvanism.—Friday, Feb 1, S. Logan, Esq., on Phrenology. At half-past eight precisely.

The female relations, and friends of members and students, may attend the lectures, and have the use of the circulating library, at 5s. per quarter; or attend the lectures only, at 3s. per quarter. A subscription of 10*l.* constitutes the donor an honorary member for life.—The affairs of the Institution are conducted by a President, Vice-Presidents, Treasurer, and Committee-men, elected periodically, by ballot; to which privilege each member is eligible six months after entrance.

Tower Street Mutual Instruction Society.—Monday, Jan. 28, Mr. T. Shearman—Question—Will the proposed People's Charter answer the expectations of its advocates?

Each member is entitled to introduce a friend on each each evening of meeting, which takes place every Monday evening at eight o'Clock; when a lecture or essay is delivered on a question opened for discussion; and also on Wednesday evenings, when the subject of Monday, if adjourned, is resumed; but when there is no adjourned subject the Society meet for reading and conversation.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, Jan. 29, — Gregg, Esq , on Perspective.—Feb. 5, Dr. R. D. Thomson, on the Geology of Great Britain. At half-past eight.

The reading-room is open every evening (Sunday excepted) from six till ten, and the tables are furnished with the morning and evening papers. Subscription 5s. per quarter, with permission to introduce a friend to the lectures. Ladies 3s. Juniors (under 16) 3s. Entrance 1s. Single Tickets 6d.

Poplar Institution for Mutual Instruction, and the Promotion of Literature, Science, &c., East India Road.—Tuesday, Jan. 29, Mr. Baker, on Chemistry. Friday, Feb. 1, Discussion on Animal Magnetism.

Subscription, 5s. per quarter. Each member is allowed to introduce one lady to the lectures, etc. Associates, under eighteen years of age, 2s. 6d. per quarter. Single lecture tickets 1s. each.

ANSWERS TO QUERIES.

Coloured Crayons.—Sir, I beg to inform "A. L. B." that crayons, or creta lœvis, as they are called, are coloured earths and stones. Red crayons are made of red chalk or blood-stone. Black crayons are made of black lead and charcoal, sawed into the proper shape. All other coloured crayons are composed of earths reduced to a paste. They must be cut into the proper size after they are prepared, that they may be rolled into pastils, for the convenience of using them. W.

Sir,—I have sent the following answers to "L. E.'s" queries on essences. W. G. A. H.

Essence of Orange.—Spirit of wine half a pint, orange peel, cut, three ounces, pounded orris root two drachms, musk two grains.

Essence of Lemons.—Spirit of wine half a pint, lemon-peel three ounces.

Essence of Musk.—Spirit of wine half a pint, pounded musk fifteen grains.

Essence of Ambergris.—Spirit of wine half a pint, ambergris thirty grains.

Essence of Cloves.—Spirit of wine half a pint, powdered cloves an ounce and a half.

Put each essence into a bottle, and let it stand in warm water, in a saucepan, near the fire, during two or three days, then strain it through blotting paper.

To take out Ink Stains on Paper.—Mix one teaspoonful of burnt alum, quarter of an ounce of salt of lemons, quarter of an ounce of oxalic acid, in a bottle, with half a pint of cold water; to be used by wetting a piece of calico with it and rubbing it on the spots. The above mixture is also very useful for removing spots from cloth, silk, &c.

To Tint Landscapes.—The following is the way to tint landscapes in water colours, which may be useful to "L. B." After the outline is completed, the sky and distances are done over with a thin wash of colour, and the ground and front objects with body colours; the whole is then wrought up to proper effect with stronger colours, alone, or mingled with Indian Ink. Sometimes drawings are washed over with Indian ink, and then finished with the requisite colours. Drawings executed with colours only are too glaring, and have a bad effect. In whichever method drawings are done, the lights require more finishing than the shades, in which a rough sort of pencilling has an excellent effect; and by attention to the middle tints the beauty of the drawing is fully attained.

Trinity Square, Southwark. F. P.

QUERIES.

Sir,—I beg leave to inquire of you where Martin's Mechanical Arithmetical Frames are to be bought, what is the price, and if the knowledge of their use is attainable by any other means than by the teaching of a master; if any works are published for that purpose, and the price. An answer in the Mechanic will much oblige AN INQUIRER.

[In reply to "Enquirer," we beg to state that Martin's Arithmetical Frames can be had of Mr. Picton, British and Foreign Schools, Borough Road, London. Their use is acquired in a few minutes. Directions are given with the price, which is about thirty shillings.]

Sir,—Can any of your readers give me the rule (if there is one) to find the diameter or circumference of a circle, if the length of the chord and versed sine are given. The case to which I wish to apply it is a circuler saw, the curve of which, on some wood, is large enough to give a chord of nine, to a versed sine of one inch. ELECTRON.

"A Lady," would feel much obliged if any of our correspondents could inform her how to make verbena and aromatic vinegar.

"T. F." wishes to know the difference between writing and copy ink, and which is the best method of making the latter?

TO CORRESPONDENTS.

Archttector. *We thank him for his offer, and shall be glad to receive any interesting papers he may favour us with. We trust our correspondent will excuse the liberty we have taken in substituting English for Greek characters in his signature; many English readers are unacquainted with the Greek Alphabet, and it is unpleasant to find words whose articulation is unknown.*

Formator. *The description of his stove will, no doubt, be acceptable to our readers.*

J. Banks. *The process employed by Daguerre (mentioned in our last number) for rendering the picture of the camera obscura permanent, is not divulged; the parts where the light falls are white, and the shaded parts remain dark, which is a contrary effect to that usually observed with preparations of silver.*

Hints to Mechanics *received and highly approved. It shall be noticed next week.*

The Little Mineralogist, *and some others, shall also be reviewed in our next.*

W. R. H. *The quantity of lead remaining in a patent ever-pointed pencil, may be ascertained by turning the screw. The plan which he suggests of making a long aperture near the point, does not appear to us to offer any advantage.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY; and published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

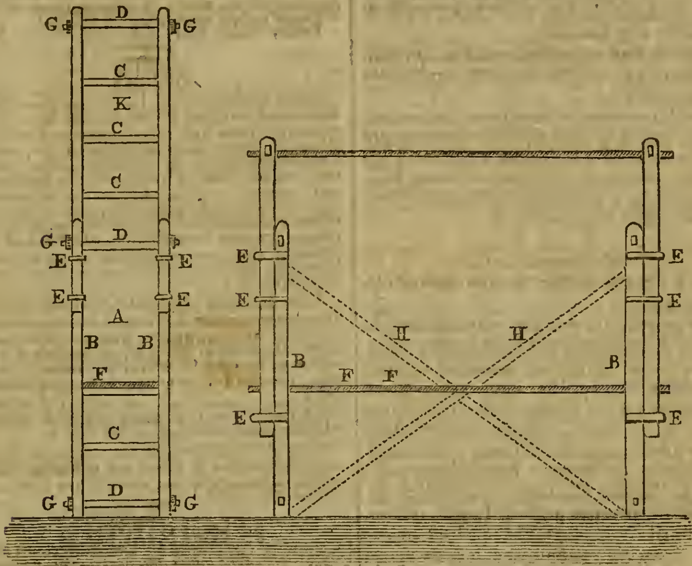
THE

MECHANIC AND CHEMIST.

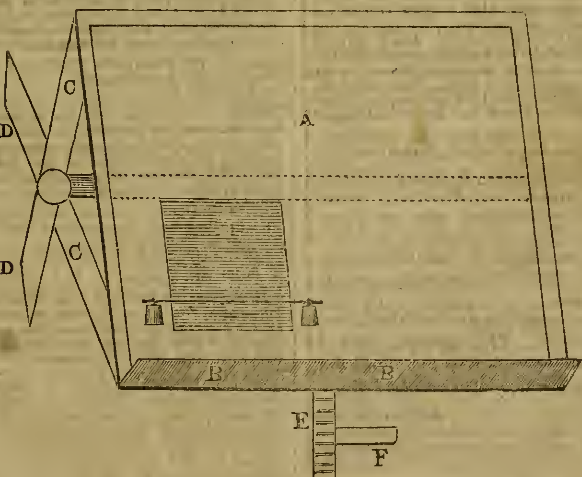
A MAGAZINE OF THE ARTS AND SCIENCES.

No. V. NEW SERIES. | SATURDAY, FEB. 2, 1839. (PRICE ONE PENNY.) | No. CXXVI. OLD SERIES.

IMPROVED PORTABLE SCAFFOLD—Fig. I.



MANUFACTURE OF LOOKING GLASS—Fig. II.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

IMPROVED PORTABLE SCAFFOLD.

(See Engraving front page.)

To the Editor of the Mechanic and Chemist.

Sir,—In the scaffolds now in use there is one great fault, the putlocks* resting on single bricks in a green wall, thereby rendering it insecure (suffice it to say, not so secure as it would have been in the absence of the putlocks), for it is a fact, well known to architects and builders, that any weight placed or resting on a green wall is injurious to it. In the plan now before us, no injury to the wall, or any part of the building can accrue from its usage; the general appearance is far better; and it is much safer for use, as it prevents the accidents which are almost constantly happening, from the breaking of the cord and various other things, which are not used in my plan.

DESCRIPTION.

A is a kind of ladder, constructed of two strong poles, B B, into which strong rails, C, are morticed, on which the scaffolding boards, F, rest, and are temporarily fixed. When the building has reached the top of the first ladder another one can be fixed, by the ends passing through strong iron rings, E, or fixed in any manner which the builder may think secure. It is generally desirable that the tops of the poles reach no higher than the building; then, by taking out the rails C, it can be lowered until it reaches the desired height (vide front view), and the boards placed on the top rails. If it be thought the weight on the boards is too heavy for the ladders to preserve the perpendicular, it may be remedied by having braces, H. morticed in the poles; but if the bottom parts are firmly and properly fixed in the ground, it will support almost any weight. Two or three rails must be omitted just above the scaffolding boards, to allow a free passage to any part of the scaffold. It is rendered portable, by the bottom and top rails (which are of iron) passing through the poles, and nuts, C, firmly screwed on. Thus, when it is wished to remove the scaffold, the nuts being unscrewed, the poles will separate, and the rails take out. Care ought to be taken that as light a weight as possible be kept on any scaffold. The ladders must be kept 14 or 15 feet apart.

I am, Sir, your's respectfully,

Architector.

* That part of the scaffold one end of which is attached, transversely, to the ledgers, and the other end rests on a brick in the wall.

THE GREAT WESTERN RAILWAY.

(Continued from page 29.)

The curves and gradients are better in the western than in the northern lines; and Mr. Brunel appears fully to have availed himself of the advantages which they offer: but Mr. Hawkshaw says, "In railway lines, generally, in the same country, there will come to be a mutual dependence one upon another. And surely it must be a rather untenable doctrine to hold, that the gauge of each line is to be determined only by reference to its curves and gradients, for by such a rule it would follow, that no two lines could be alike." When the curves are bad, a wide gauge would not only occasion much friction, but danger; the narrow gauge may be well adapted to the northern lines, but why attempt to force it upon the western line, which possesses greater capabilities, after it has been decided that no connexion is to exist between them under any circumstances?

The deviation from the ordinary mode in the construction of the railway, viz. continuous longitudinal timbers, supported upon piles and cross transomes, with iron rails screwed down upon the longitudinal timbers, instead of resting upon stone blocks, as in most other railways, has also led to much controversy. We must refer the reader to the very elaborate, and, in many respects, valuable, report of Mr. Nicholas Wood, for the description and results of numerous experiments, made with a view of ascertaining the deflection of the rails, and the various motions of the carriage. There is so much discrepancy and contradiction in the various estimates of the relative expense of the two modes of construction, that we are unable to offer a well-founded opinion upon the subject.

A great deal has been said upon the subject of atmospheric resistance; that is, a great deal in quantity, but in point of information, absolutely nothing. Dr. Lardner represents it to be so much greater than hitherto supposed, that it will become an insurmountable barrier to any considerable increase of speed; Mr. Babbage makes very short work of it; he says it is as the square of the velocity, and so dismisses the subject. Not long ago, Dr. Lardner, in a public lecture, stated that he had directed an experiment to ascertain the velocity with which a boat could be drawn through the water in a canal. By means of a tube inserted in the bottom of the boat, he was enabled to observe how much the boat was forced upwards by the action of the water upon the oblique surface presented by the fore part of the boat.

Now instead of explaining this effect as other people do, by resolving the force of the water into two directions, the one opposing the horizontal progress of the boat, and the other inclining it perpendicularly upwards, he tells his audience that the force which raises the boat is its not having time to sink! The opinion of this gentleman upon the subject of the resistance of fluids, cannot therefore possess great weight.

In a quiescent atmosphere, the resistance is evidently as the square of the velocity; it requires neither experiment, authority, or extraordinary sagacity, to establish this fact; the resistance to motion in all bodies, is as the quantity of matter, and the velocity with which it is moved. The quantity of air displaced in a given time is proportional to the velocity; therefore $V \times Q$ is proportional to V^2. It must be observed that this only refers to the resistance in front of the body, without considering other circumstances which may, and do, impede its progress. When a body moves with a very great velocity through the air, a vacuum is formed behind, because the velocity of the body is greater than that of the air, which is constantly rushing in to fill the space previously occupied by the body. It is probable that this effect may take place, in a small degree, at a velocity not exceeding that which may be attained by a steam-carriage. The experiment might easily be made by placing a barometer immediately behind the last carriage. In all that has hitherto been said, a quiescent atmosphere has been assumed, which is only one particular case, and that too of rare occurrence. A lateral wind, blowing at right angles to the direction of a train, would materially impede its progress; not only the projections, but the spaces between the carriages, would occasion considerable resistance; but whatever the effect of atmospheric resistance may be, it may, when required, be materially diminished, by removing, as much as possible, all inequalities throughout the whole length of the train, and forming the front of the engine so as to offer the least possible resistance. The experiments described in the report are utterly inadequate to distinguish the resistance of the air from other impediments; the experiment which we recommend is this: When there is a steady wind blowing in the direction of a straight line of road, start a train with a given load, and pressure of steam to produce a velocity equal to that of the wind;—from 35 to 40 miles per hour would be a convenient speed;—then wait for a quiescent atmosphere: and if care be taken to preserve the same pressure of steam, and all other things remain the same, the difference of the two velocities will give the retardation occasioned by the action of the air in the second trial; but a small correction will be required for the diminution of friction occasioned by retardation.

Our limited space will not allow us to extend our observations further at present; suffice it to say, that the proprietors have decided in favour of Mr. Brunel's plans, notwithstanding the hydra votes of certain great shareholders, who appear to have exerted themselves to the utmost to obtain the adoption of the gauge and other modes of construction of the northern lines.

MANUFACTURE OF LOOKING GLASS.

(See fig. II. front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Allow me, through the medium of your invaluable little work, to forward the following answer to the query of "A Young Experimenter," in No. 121, in which I have given the trade method, and which your correspondent can adopt to himself on a smaller scale.

A flag-stone, A, is procured from about 5 feet by 3, to about 6 feet by 12, which is mounted in a trough B, the whole of which is fixed in a frame, *c c*, *d d*; *c c* is fixed to the frame surrounding the stone, while *d d* is fixed to the floor: *c c* acts on a swivel in *d d*, an axle from which goes under the stone in direction of the dotted line, and meets with a similar frame on the other side. In the front of the stone just under the frame, is a screw E fixed in the floor and in the frame, the use of which is to incline the stone at pleasure by means of the handle F: there is usually a hole in one corner of the trough, by which to draw off the surplus silver. Thus far prepared let us proceed to the operation. The stone A must be perfectly flat and smooth. Now let us suppose we have a glass 10 inches by 8 to silver: make the stone dry by rubbing it with dry whiting; then lay a piece of tin-foil about an inch larger than the glass on the stone, and make it lay quite flat by rubbing it with a piece of half-inch deal with the edge rounded off: now take a little quicksilver and lay on the foil, and gently rub it with a piece of flannel fastened on to a piece of wood, which is technically called a quickener (the back of a flat brush would do), till it appears bright all over, then

gently sweep it off, and lay a quantity of clean silver on till it is raised on the foil an eighth of an inch; now gently sweep the front of the silver for about an inch with a hare's foot, and lay a piece of clean paper just over the edge, and secure it by a weight on each side. The use of the screw before mentioned is to slightly incline the stone towards the operator, so that the greatest quantity of silver may be in the front. Now having cleaned your glass, lay it on the paper, and gently press on it aud move it forward, taking care that the glass at no time rises from the silver: now secure it from sliding by putting a weight on each side, half on the glass, and half on the stone, and completely cover it with weights (weights about three inches square, and made of lead, are generally used, the object of which is to press out the silver), and put a weight at the bottom to prevent it from slipping, and incline the stone the other way, so that all the silver may run off. It must be left in this state for at least four hours, twelve would be better. The next operation is to take the glass up, which may be done as follows: place the left hand against one side of the glass, while with the right hand you introduce a small pen-knife under the glass, and carefully raise it up, and let it stand upright for some hours before using it, taking care that the edge which was the lowest on the stone, be kept at the bottom ever afterwards, else the glass will, as it is termed run; that is, appear marked like a tree.

I am, Sir, your's truly,

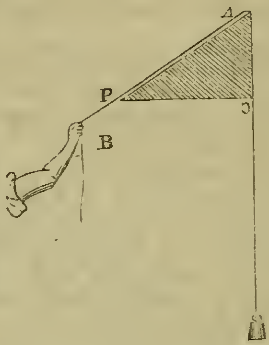
J. F——Y.

ON THE MECHANICAL POWERS.

NO. V.

The next class of simple machines is that which has been called the *cord.* If a rope were perfectly flexible, and were capable of being bent over a sharp edge, and of moving upon it without friction, we should be enabled by its means to make a force, in any direction, overcome resistance, or communicate motiou in any other direction. Thus if, in fig. 1, A, be such an edge, a perfectly flexible rope passing over it, would be capable of transmitting a force, D B, to a resistance, C D, so as to support or overcome D; or by a motion in the direction of P B, to produce another motion in the direction C D. But as no materials of which ropes can be constructed, can give them perfect flexibility, and as in proportion to the strength by which they are enabled to transmit force, their rigidity increases, it is necessary in practice to adopt means to remove or lessen those effects which attend imperfect flexibility, and which would render cords practically inapplicable as machines. When

Fig. 1.



a cord is used to transmit a force from one direction to another, its stiffness renders some force necessary in bending it over the angle, A, which the two directions form; and if the angle be sharp, the exertion of such a force may be attended with the rupture of the cord. If, instead of bending the ropes at one point over a single angle, the chance of direction were produced by successively deflecting it over several angles, each of which would be less sharp than a single one could be, the force requisite for the deflection as well as the liability of rupturing the cord, would be considerably diminished. But this end will be still more perfectly attained, if the deflection of the cord be produced by bending it over the surface of a curve. If a rope were applied only to sustain, and not to move a weight, this would be sufficient to remove the inconveniences arising from its rigidity. But when motion is to be produced, the rope, in passing over the curved surface, would be subject to excessive friction, and consequently to rapid wear. This inconvenience is remedied by causing the surface on which the rope runs to move with it, so that no more friction is produced than would arise from the curved surface rolling upon the rope. All these ends are attained by the *common pulley*, which consists of a wheel called a *sheave*, fixed in a block turning on pivots. A groove is formed in the edge of the wheel in which the rope runs, the wheel revolving with it. Fig. 2 is such a

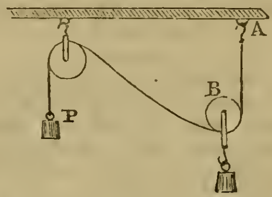
pulley. From the definition of a flexible cord, it follows that its tension, or the force by which it is stretched throughout its entire length, must be uniform.

FIG. 2.

When the rope passes over a single wheel, which is fixed in its position, as in fig. 2, the machine is called a fixed pulley. Since the tension of the cord is uniform throughout its length, it follows, that in this machine the power and the weight are equal; for the weight stretches that part of the cord which is between the weight and the pulley, and the power stretches that part between the power and the pulley; and since the tension throughout the whole length is the same, the weight must be equal to the power. Hence it appears no mechanical advantage is gained by this machine; nevertheless, there is scarcely any engine, simple or complex, attended with more convenience. In the application of power, whether of men or animals, or arising from natural forces, there are always some directions in which it may be exerted to much greater convenience and advantage than others, and in many cases the exertion of these powers is limited to a single direction. A machine, therefore, which enables us to give the most advantageous direction to the moving power, whatever be the direction of the resistance opposed to it, contributes as much practical convenience as one which enables a small power to balance or overcome a great weight. In directing the power against the resistance, it is often necessary to use two fixed pulleys. Thus, in elevating a weight to the top of a building by the strength of a horse moving below, two fixed pulleys may be used. The rope is carried from the weight to be raised over the pulley at the top of the building; the rope passes, and returning downwards, is brought under the pulley at the bottom of the building, and drawn by the animal on the horizontal plane. In the same manner sails are spread, and flags hoisted on the yards and masts of a ship, by sailors pulling a rope on the deck. By means of the fixed pulley, a man may raise himself to a considerable height, or descend to any proposed depth.

Fig. 3 is a *single moveable pulley.* A cord is carried from the fixed point, A, and passing through a block, B, attached to a weight, W, passes over a fixed pulley, C,

FIG. 3.



the power being applied at P (the parts of the cord on each side the wheel, B, should have been drawn parallel); the whole weight, W, being sustained by the parts of the cords B C and B A, and these parts being equally stretched, each must sustain half the weight, which is, therefore, the tension of the cord. In this machine the weight is twice the power. If the parts of the cords B C and B A be not parallel, a greater power than half the weight is, therefore, necessary to sustain it. From its portable form, cheapness of construction, and the facility with which it may be applied in almost every situation, the pulley is one of the most useful of the simple machines. Owing to the stiffness of the cordage, and the friction of the wheels and blocks, it is computed that in most cases two-thirds of the power is lost. The pulley is much used in buildings; but its most extensive application is found in the rigging of ships, where almost every motion is accomplished by its means.

Examples on the Pulley.

Rule.—Divide the weight to be raised by twice the number of moveable pulleys, and the quotient is the power required to raise the weight.

Example 1.—What power is requisite to raise 250 lbs. with a pair of four-shieved blocks, the one block moveable and the other fixed?

$4\times2=8$ and $\frac{250}{8}=31\cdot25$ lbs. power.

Example 2.— What weight will a power of 31·25 lbs. raise, when applied to

a pair of four-shieved blocks, the one moveable and the other fixed?
$4\times2=8$, and $31{\cdot}25\times8=200$ lbs. raised.

A. D. M.

In No. 123, p. 12, a trivial error occurred, viz.:—
$\frac{80\times60}{80}=96$ should be $\frac{80\times60}{50}=96$, and
$\frac{124\times72}{620\times124}$ should be $\frac{124\times72}{620\times125}=12$ in.

CURSORY REMARKS ON TOXICOLOGY.

No. I.

INSTANCES of fatal occurrences, resulting from the effects of poisons, are, it is to be regretted, both numerous and frequent; and were these catastrophes confined to those persons who wickedly presume to rid themselves of an existence, which, from some cause or other, may have become burdensome to them, it would then be sufficiently deplorable, but our sympathy must be still further excited, by knowing that death from poison is often the result of inadvertence, such as children eating berries of a poisonous nature, which happen to be agreeable to the palate; or adults taking deleterious substances in mistake for medicine. The writer, when an infant, once got hold of a bottle containing oil of vitriol, and with that natural propensity to taste every thing, which so much assimilates children with the monkey tribe; he was about to swallow a draught, when the vial was providentially rescued from his grasp.

The attention of the faculty would naturally be directed to so important a subject as the present, and, as might be expected, medical literature has been enriched by many luminous works on poisons, amongst which may be named those of Drs. Paris, Mead, Fodere, Brodie, Hunter, Hume, Orfila, and Cox.

But the writer does not consider the present article will be rendered less necessary, or less interesting, by the existence of these volumes; for as the subject is no doubt considered by the great mass of the readers as abstruse, it is probable their circulation and perusal has been confined principally to the medical profession. The object of the present paper is to render the nature, effects, and antidotes of poisons notorious; and no one will be prepared to deny that such an object is highly desirable.

Poisons are divided by Buchan into three kinds,—mineral, vegetable, and animal. Other writers make a further distinction, and class the following kinds separately:—Corrosive — as mercury, arsenic, antimony, gold, zinc, concentrated acids, pure or caustic alkalies, cantharides or Spanish blistering fly, copper, &c. Astringent — lead only. Acrid — principally vegetable, as hellebore, hemp agrimony, and other drastic or violent purgatives. Narcotic — as opium, henbane, stramonium, or thorn apple, &c. Narcotic-acrid—consisting of such ingredients as produce the united effects of narcotic and acrid poisons; some of the most virulent are of this class, amongst which may be noticed the nux vomica or Indian poison nut, hemlock, tobacco, belladonna or deadly night shade, digitalis or foxglove. Septic—as putrid odours from decaying animal matter, the venom of serpents, sulphuretted hydrogen gas, &c.

The above arrangement is given by Fodere, adopted in its main points by Orfila and others, and quoted by Forsyth; and perhaps, after all, the more simple classification of William Buchan is equally effective.

VANDERKISTE, JUN.

COST OF AMERICAN RAILROADS.

THE first six miles of the Baltimore and Ohio Railroad, which is formed in an expensive manner, and on a very difficult route, has cost, on an average, about 12,000*l.* per mile. The railroads in Pennsylvania cost about 5,000*l.* per mile; the Albany and Schenectady Railroad upwards of 6,000*l.* per mile; the Schenectady and Saratoga Railway 1,800*l.* per mile. The average cost of American railroads is 4,942*l.* per mile. Some difficulty was found in obtaining accurate information of the annual expenses of maintaining the railways. On the Boston and Worcester railroad, the annual expenditure for repairing the road, carriages, and engines, and providing fuel and necessary attendance for 43½ miles of railway, was estimated at 6,829*l.*, or 157*l.* per mile. The annual expense of the Utica and Schenectady railroad repairs, 77 miles long, is 28,000*l.*, or 363*l.* per mile. These expenses are much lower than similar ones in England.—*Railway Mag.*

Bridges.—Perronet thinks that a bridge of 500 feet span might stand; the bridge of Nantes having sunk to a radius of 500 feet.

GELATINE.

Jelly, an animal substance soluble in water, but not in spirits, capable of assuming a well-known elastic or tremulous consistence by cooling, when the water is not too abundant, and capable of being converted into liquid again by increasing its heat. This property remarkably distinguishes it from *albumen*, which becomes thickened by heat. It is *precipitated* in an insoluble form by *tannin*, and it is this action of tannin on gelatine, that is the foundation of the art of tanning leather.

The immortal Gay Lussac, and the no less renowned Shenard, give the following analysis of gelatine :—

Carbon	47·881
Oxygen	27·207
Hydrogen	7·914
Azote	16·998
	100·000

It is to be regretted, that men of science are much more in the habit of using technical phrases than there is any occasion for. If the above article were placed in the hands of the unchemical reader in its present state, he would derive small information from it ; but I have added a glossary, which will render it equally available to the mechanic as well as the man of science ; and in my future communications to the "Mechanic and Chemist," I shall follow up the plan, and also recommend it to yourself, Mr. Editor, and likewise to your correspondents. I am a plain man myself, and like to see everything else plain.

Albumen.—It forms the cheese in milk, makes up the greater part of the white of eggs, and is the principal part of the *serum* of the blood.

Serum.—1. Whey ; 2. The yellow fluid which separates from blood when cold and at rest.

Precipitated, cast down.—When two bodies are united, and another added, which has a greater affinity* or attraction for one of the previous two, than the other which was united with it, it instantly combines, and the separated ingredient falls to the bottom of the vessel, and is called a precipitate.

Tannin.—A principle obtained from vegetables, one of their immediate parts, and used in dressing leather.

William V——e.

* For a most excellent and lengthy article on affinity, see "Penny Mechanic," Vol. II., No. 43. p. 23.

TO PRESERVE ARTICLES FROM MILDEW.

To the Editor of the Mechanic and Chemist.

Sir,—Collectors of books will, no doubt, be glad to learn that a few drops of any perfumed oil will ensure their libraries from this pest. This principle seems also applicable to the preservation of seeds, particularly in cases where they are sent from distant countries by sea, when it is well known that they often perish from this cause. Dampness, of course, will perform its office at any rate, if moisture is not excluded ; yet it is certain that the growth of the vegetables, which constitute mould, accelerate the evil, whether by retaining moisture, or by what means, is not very apparent. This, in fact, happens equally in the case of dry rot in wood, and, indeed, in all other cases where this cause operates. It is a curious illustration of the truth of this view of the remedy, that the aromatic seeds of all kinds are not subject to mould, and that their vicinity prevents it in others with which they are packed. They also produce the same effect daily, even in animal matter, without its being suspected ; I need only to remark, that it is common to put pepper into collections of insects or birds without its having been remarked that it had the same power of keeping off mould, as of discouraging or killing the *primus omnivorus*, or other insects that commit ravages in these cases.

In concluding these hints, I might add, in illustration of them, that gingerbread, and bread containing carraway seeds, is far less liable to mouldiness than plain bread. It will be a matter worthy of consideration, how far flour might be preserved by some project of this kind.

I remain, Sir, your's, &c.

A Constant Reader.

To prevent Ink from Freezing.—Instead of water use brandy, with the same ingredients which enter into the composition of any ink, and it will never freeze.

To make Windsor Soap.—Melt hard curd soap, and scent it with oil of karni and essence of bergamot. P. T.

Nitric Acid for Tanning.—Mr. Hackett discovered, some years ago, that a substance very similar to tannin, possessing all its leading properties, and actually capable of tanning leather, nay be produced by exposing carbon, or any substance containing carbonaceous matter, whether vegetable, animal, or mineral, to the action of nitric acid.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, Feb. 6, R. Ogilvie, Esq., on Insects.—Friday, Feb 8, S. Logan, Esq., on Phrenology. At half-past eight precisely.

Tower Street Mutual Instruction Society.—Monday, Feb. 4, Mr. Coupland, on the Intellectual and Social State of England, from the earliest period. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, Feb. 5, Dr. R. D. Thomson, on the Geology of Great Britain. At half-past eight.

Poplar Institution, East India Road.—Tuesday, Feb. 5, Mr. Cromwell, on the Ancient World.—Friday, 8, Discussion,—Use of Distilled Spirits.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 7, J. M. Leigh, Esq., on Eloquence and Elocution. At half-past eight.

The reading-rooms, supplied with a variety of morning and evening newspapers, magazines, reviews, and periodical works of merit, are open from nine in the morning till ten at night. A rapidly-increasing library of circulation and reference is also open for the use of the members. It now contains 3,000 volumes. The subscription is 24s. per annum, or 6s. quarterly, payable in advance. Ladies are admitted (on the introduction of members) to the lectures and use of the library) at 12s. Sons and apprentices of members are admitted to the lectures or classes at the same sum—payable yearly, half-yearly, or quarterly, in advance. No entrance fee.

Society for Promoting Practical Design, Saville House, Leicester Square.—Monday, Feb. 4, B. R. Haydon, Esq., on Beauty. At a quarter past eight.

The schools of this Society continue to be open, morning and evening, for instruction in the elements of design, connected with manufactures. The peculiar utility of these schools in every branch of trade has been fully appreciated by the great number of students who attend them. The attention of upholsterers, jewellers, chasers, carvers, engineers, carpenters, cabinet makers, and other artisans and tradesmen, is particularly called to the facilities afforded by this Institution. Fees for students, for evening schools and lectures, under 18 years of age, 6s. per quarter; above that age 7s. Visitors are invited to inspect the school from 11 to 4 in the day-time, or from 6 to 10 at night, where further particulars may be obtained.

London Temperance Institute, 167, Fleet Street.—Friday, Feb. 8, W. G. White, Esq., on Meteorology.

The Institute is supported by subscriptions and donations of money, books, apparatus, &c. A subscription of 10s. per annum, paid in advance, either quarterly or yearly, entitles to all the advantages of the library, reading-room, lectures, and registry.

ANSWERS TO QUERIES.

Sir,—I beg to submit the following answers to your correspondents.

Yours, &c. T. BAILEY.

Eccentric Motion.—"G. Orchart." The purpose of the eccentric motion is to convert a continued circular into a reciprocating rectilinear motion, and in a steam-engine usually consists of a ring of metal, to which is fixed the rod intended to work the slide. Inside this ring is fitted a circular plate of metal, turning easily within it; this plate revolves (with the crank-shaft to which it is fixed) NOT on its centre, but at a distance from it equal to HALF the space through which it is intended the rod should move. The ring should be in two parts, and flanched together. G. O. should go on board a steam-boat, where he would see the application of this apparatus. Boats working with one engine are liable to stop on the dead centre, as it is called, but a small force is sufficient to start them again. "G. O." can at any time apply a fly-wheel if he sees occasion.

Tin Foil.—"T. Gowland" may procure tin foil at Dymond's, Chemist, Holborn Bars.

The Cushion of an Electrical Machine is usually made of roan or Morocco, having a flap of same leather, with the flesh side outwards, to hold the amalgam. To this flap the silk should be sewed.

Glass Cylinders.—"H. H." may purchase these at the Falcon Glass Works, Holland Street, Blackfriars, at about 1s. 6d. per lb. Other glass apparatus at about 1s. 3d.

"B. R. S." will find mercury the cheapest means of connection, but a more ready way is by screws, which he can examine at Clark's, Lowther Arcade, Strand; they have, however, one disadvantage, that is expense.

Water may be decomposed by copper wire, which may be coated by cleaning it with nitric acid, and dipping it into a solution of nitrate of silver or mercury.

To Solder Copper and Zinc.—Soft solder is proper to solder copper and zinc, using plenty of rosin. The metals must be perfectly free from oxide.

QUERIES.

Sir,—Will any of your readers answer the following query;—How must a triangle be geometrically constructed, having the following data, viz. the base, A C, the angle B A C, and the difference between the perpendicular B D, and side B C?

Worcester. J. BURLISON.

"Ergo" wishes to be informed where he can purchase a book of instructions for painting on glass.

"A Subscriber" wishes to know where Mr. Hancock's manufactory is situated, and how he can obtain permission to inspect his carriage. Whether the Act of Parliament, imposing heavy tolls on steam coaches has been repealed. And how he can construct a velocipede on the same principle as that of Mr. Landers, of Cowper Street, City Road.

"W. Y. Z." would feel himself exceedingly obliged if any of our correspondents would give him the best method of dyeing with woad.

TO CORRESPONDENTS.

"T. S. R., Chatham." *The pressure does not in any degree depend upon the size or form of the tube, but solely upon the perpendicular height of the mercury above the surface upon which the steam is admitted. About* 28 *inches is equivalent to the pressure of an ordinary atmosphere, and any increase or decrease in that pressure will produce a corresponding alteration in the height of the mercury, which is always in direct proportion to the pressure. His other queries shall be inserted.*

"S. S." *The expense attending a patent for the three kingdoms will exceed* 300*l. There is an article upon the subject in our last volume, from which our correspondent may collect some useful, but disheartening, information. The more our patent laws are known, the more unhesitatingly they are condemned.*

Rama *and some others will find that their wishes have been anticipated. We have laid before our readers all the particulars we could obtain concerning the splendid invention of M. Daguerre; it is not probable that he will allow any of the pictures to leave his possession till he has secured the reward to which he is so justly entitled.*

The Index to Vol. III., with a splendid frontispiece of J. Rennie, is now ready.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY; and published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. VI. NEW SERIES. | SATURDAY, FEB. 9, 1839. (PRICE ONE PENNY.) | No. CXXVII. OLD SERIES.

NOTT'S PATENT STOVE.

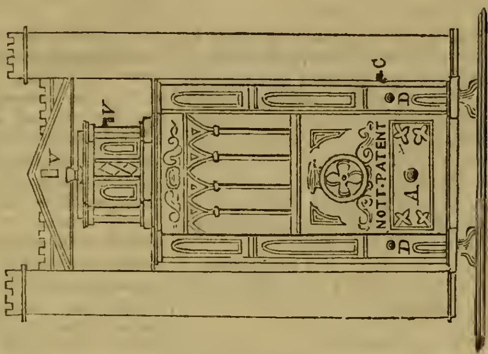


FIG. II.

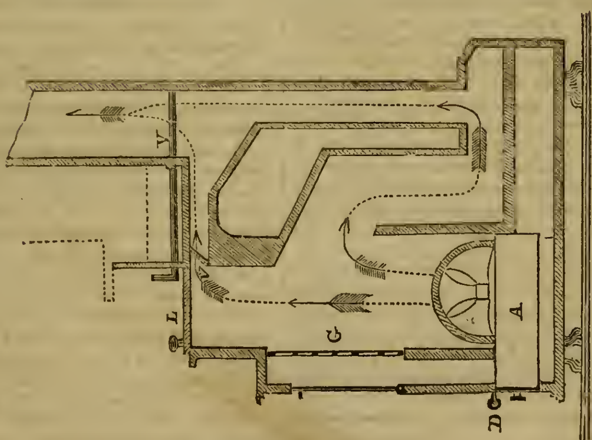


FIG. I.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

NOTT'S PATENT STOVE.

(See Engraving front page.)

To the Editor of the Mechanic and Chemist.

Sir,—According to promise, I send you a sketch of Nott's Patent Stove, which is, I think, sufficiently explicit without much description. The one I have in my possession, is made to fit a common fire-place and flue. It has been in use five years, and from which I can confidently recommend them (especially for offices). They can be made to stand alone like a common ship stove.

DESCRIPTION.

V are valves to regulate the draft of air; A is an ash-box; G is a front grating; B is a semi-circular grating, turning on an axle C; this serves to clear the grate of ashes. There is also another valve about seven feet up the flue, which is not shown in the drawing. The arrows and dotted lines show the direction of the draft; D D are dampers; L is a sliding lid, through which the coals are put. I have dotted in the chimney-piece in fig. 1.

Formator.

P.S.—The same letters of reference apply to figs. 1 and 2.

PERMANENT PICTURES FROM THE CAMERA OBSCURA.

In addition to the notice in a former number of this important and surprising discovery, we have collected some further particulars, which we give on the authority of M. Arago, the astronomer royal, M. Biot, and M. Humboldt.

M. Daguerre is not the first who has conceived the idea of fixing the picture, displayed by the camera obscura, by means of certain chemical preparations, which possess the property of changing their colour when exposed to the action of light. One of the most sensible hitherto known, is the chlorate of silver, which, when prepared colourless, assumes a black or blueish colour under the influence of luminous rays. It was observed, that when a white sheet of paper covered with this substance newly prepared, received the image formed in the camera obscura, its colour was more or less changed in different parts, according to the different intensities of the light which formed the image. In those parts where the white rays fell, the paper became black, and in the parts where no light arrived, the paper remained white. A true image of the external bodies could not, therefore, result from this process, since the white became black, and the black became white upon the paper. But even this imperfect delineation was a triumph, and would have been valuable, could it have been rendered permanent; but the instant it was placed in the light, the white parts began to change colour, and were soon obliterated. M. Daguerre has discovered a substance infinitely more sensible to the action of light, than the chlorate of silver, and which changes colour inversely; that is to say, it leaves on the paper dark tints for the shadows, and white for the light, and every intermediate shade exactly corresponds with those exhibited by the external objects, except there being no diversity of colour, but only light and shade, as in an India-ink drawing. When the desired effect is produced, the process is, by some means, instantly stopped, and the picture may be exposed to the light, without undergoing any further alteration. In the achromatic camera obscura, the image is perfectly distinct, which is not the case in those commonly sold at the opticians'. This distinctness is equally apparent in the pictures formed by the process of M. Daguerre; every object is so perfectly defined, that minute details, which cannot be perceived by the naked eye, become visible by the aid of a magnifying glass. The process is completed in eight or ten minutes in ordinary weather, and, in clear sunny weather, two minutes, or even less, will be sufficient.

This invention, considered in reference to the services it is likely to render to science, is of great importance; a reactive so sensible as that discovered by M. Daguerre, will open a field for experiments hitherto reputed impossible. Such are the experiments upon the light of the moon; experiments upon this subject appeared to the Academy of Sciences sufficiently important to induce them to appoint a committee, which was composed of M. de Laplace, M. Malus, and M. Arago, to conduct the investigation. The light of the moon is estimated at only a three hundred-thousandth part of the light of the sun; it was, nevertheless, attempted to produce some sensible effect, by concentrating the rays by means of a lens of great dimensions. A lens of extraordinary magnitude was brought to Paris from Austria, and in its focus was placed some chlorate of silver, the most sensible reactive then known, but no alteration in the colour was perceived. The same experiment has been made with the Daguerre process, and in twenty minutes a white image of the moon was produced on the black ground of the prepared paper. We have the au-

thority of M. Arago for this statement; but it appears somewhat enigmatical, that the feeble light of the moon should produce a white image, while the much stronger light proceeding from partially shaded objects in day light, leave a dark tint on the paper. M. Arago says, the lens employed in this experiment was much less powerful than the one used in the former experiment. The protracted time of action (twenty minutes) may probably explain this discrepancy.

The following is from M. Biot:—"I can speak of the perfection of the results obtained, not from my own judgment, but from that of a celebrated artist, M. Paul Delaroche, in whose company I have examined some of the views which have been taken by the new process with the camera obscura. M. Delaroche thinks that pictures of this kind may afford useful lessons even to the most talented painters, upon the manner of expressing by means of light and shade, not only the relief of bodies, but their peculiar characteristic tints. The same basso relievo in marble and in plaster is differently represented in the two designs, so that it is perceived at first sight which is the image of the marble, and which is the image of the plaster.

In these pictures may be perceived even the time of the day. Three views of the same edifice were taken, one in the morning, one in the middle of the day, and one in the evening, and no one could mistake the effect of the morning for that of the evening, although the height of the sun, and consequently the relative length of the shadows, were the same.

It is evident, that since the action of the light is not instantaneous, that the objects should be immoveable to obtain a distinct design. It often happens that trees are indistinctly traced, when their branches are agitated by the wind. This effect of partial agitation is shown in a singular manner in two of the views taken by M. Daguerre. In the front of one of them there is a carriage and a horse which remains without motion in the body, and this part is very well represented, but the head is moving up and down to take some hay from the ground, and the head and neck are not marked; but there exists a sort of smear between the highest and lowest place occupied by the head. In the other there is a man having his shoes cleaned; he has not moved, and is distinctly delineated, but the shoe-cleaner, who was in continual motion, presented only a confused image, especially about the arms."

We shall watch the progress of this magnificent discovery with the greatest interest, and when anything further transpires, it shall be immediately made known to our readers.

LENGTH OF THE YEAR.

To the Editor of the Mechanic and Chemist.

SIR,—In your notice to Correspondents, on Saturday last, you say that the exact length of the year, or one revolution of the earth about the sun, is 365 days, 6 *hours*, 48 minutes, 49 seconds. The year, as computed in the calendar, exceeds the true year; being there considered as 365 days, 6 hours. The *six hours* is evidently a misprint for 5; and the time should read 365 days, 5 hours, 48 minutes, 49 seconds.

I may here remark that one complete revolution of the earth is performed in 365 days, 6 hours, 9 minutes, 12 seconds, or a sidereal year; but, in consequence of the continual shifting of the equinoctial points, in a retrograde direction, the earth returns to the equinoxes or the solstices in rather less than one complete revolution; or in 365 days, 5 hours, 48 minutes, 49 seconds, sometimes computed as 48, sometimes as 51 seconds. This is the mean length of the tropical or equinoctial year; to which, by the use of the Gregorian calendar, we endeavour to assimilate the civil year, by intercalating leap years, in the manner you describe.

Although this adjustment of the calendar originated with Pope Gregory, in the year 1582, it was only introduced into this country, in 1752; and has not yet been adopted by the Russians, who still adhere to the practice of intercalating one day, every fourth year, without intermission. This adjustment was devised by Julius Cæsar, with the assistance of the astronomer Sosigenes, of Alexandria.

Closely as the Gregorian correction approximates to the truth, there is one which exceeds it in accuracy; but which is less convenient, from being more complicated. This is the Persian correction; which consists of an intercalation of 8 days, in 33 years. So that there are seven leap-years, each the fourth after the preceding one; and then a leap-year, the fifth after the preceding one.

Besides the sidereal and the tropical year, we have the anomalistic year, or interval of time that elapses between the earth's being in aphelion, or at the greatest distance from the sun, and its return

to the same point. The mean length of this year is computed at 365 days, 6 hours, 13 minutes, 59 seconds.

I remain, Sir, your's, &c.

J. S. N.

[The tropical year, which we described in our last number, is, as we before stated, a complete revolution of the earth, in its orbit, about the sun, considered separately from all other motions. At the expiration of the period, 365 days, 5 hours, 48 minutes, 49 seconds, the earth returns to exactly the same point from which it started, *relatively to the sun*. That motion which causes the precession of the equinoxes, has nothing to do with the seasons; and it was unnecessary, and, in our opinion, it would have been improper, to introduce the sidereal year, in explanation of a question relating only to the orbital motion, upon which the succession of the seasons depends.—Ed.]

ACCIDENTS ON RAILWAYS.

To the Editor of the Mechanic and Chemist.

Sir,—We are perpetually hearing of the dangers attending steam locomotion. Our newspapers are filled with accounts (some true, many exaggerated, and others false) of accidents on the various lines; and this it is that fills the minds of so many with prejudice against allpowerful and yet, controlable *Atmos.*

An accident on a railroad, by which several persons are bruised or slightly hurt, is noised abroad and made the general topic of conversation; while the undeniable fact, that, in one week, every coach upon the Plymouth road was upset and several persons killed, is scarcely known or heard of.

The fact is, accidents by coaches are occurrences so common, that the most alarming are not of sufficient interest, even for a newspaper; while an accident on a railroad, however trifling, is posted up in every nook and corner. Hence, the experience and wisdom of dotage draw the sage conclusion, that "railroads are most direful things."

It is argued by the advocates of coach locomotion, that accidents by them have, of late, been much less than heretofore.

This statement is no more than correct; for they must, or ought to know that where five coaches formerly ran, one only does so now. But, notwithstanding this diminution, I venture to affirm that, even now, the coach accidents are more numerous than those on railways.

Did the objectors to railways, on the ground of accidents, only exercise their reason (if they have any) they would, at once, see that, though accidents did happen on railways, yet the very fact rendered that mode of conveyance less liable to them; for a diminution in the number always succeeds the occurrence of accidents. To replenish them, the directors must necessarily endeavour to remove the cause of their diminution. To do this, they are more careful; and it has, of course, the desired effect.

Hoping that time will destroy the existing prejudice; and that the public will soon allow, not their fears to blind, but their reason to guide their opinions of steam locomotion,

I remain yours, very respectfully,

F. P.

BUILDING.

NO. I.

There is no part of the building that requires more diligence and attention, than the foundation, inasmuch as it has to support the whole edifice; and one error, there committed, would inevitably destroy the whole fabric, or occasion such injury, that great difficulty and labour would be required to render the building secure. Many accidents likewise accrue from the edifice being erected on improper soils: this also deserves particular attention; although liable to pass unnoticed by those unacquainted with the fact. I shall therefore endeavour to point out those soils which are most preferable and proper for the purpose of building.

Stony, clayey, and chalky are the best natural soils; and of themselves form the best foundations; and are better able to support buildings of great magnitude, both on land and in water. I recommend these as being the most preferable of all soils. Rocky soils are dangerous, especially, if in small masses; on account of the rottenness of the soil in which they are bedded. Dry gravelly soils are also ineligible; as they are not only loose and infirm, but are very liable to vacuities of large extent, which cannot be provided against by art. Wet gravel is also ineligible; but forms a better foundation, being more compact. This soil is not to be despised; as a good foundation, and one which can be trusted, may be obtained by digging sufficiently deep in the gravel, and filling up the vacuity with a substance termed concrete; generally composed of rubble, grey-stone, lime, and

river sand. Firm ground forms a good foundation. When there are to be no underground offices, the depth of excavation ought to be about one-sixth the whole height of the edifice. The presence of firm ground can be ascertained by the following experiments: If a great weight be laid thereon, it will neither sound or shake; and if a drum be placed thereon and slightly touched, it does not reverberate; and water put into a bottle does not shake.

The spot of ground being chosen, and the shape of the building decided upon, the first operator is the excavator; whose duty is to form the ground to the desired shape; and whose chief object is or ought to be to produce a perfect level; more particularly in trenches for walls, where the greatest attention is required; as if uneven, the weight will press unequally, and the walls will cleave asunder. To guard against this evil, it was customary, with the ancients, to pave the trenches with stone; and, according to Palladio, the Italians substituted planks and beams. The work performed by the excavator, can be ascertained by multiplying the length by the breadth, and the result by the depth, which leaves the answer in cubic feet.

There are various kinds of bricks; but the average size, in this country, is nine inches long, four and a half wide, and two and a half thick. Walls are technically described as being one brick, one brick and a half, or two bricks thick: thus a one-brick wall is nine inches thick; a one-brick and a half is fourteen inches; and a two-brick wall is eighteen inches thick; and so on.

It may not here be amiss to make a few remarks on the composition and way of treating mortar: on which depend, in a great measure, the binding together of the bricks, and the external appearance, &c. It is composed of well-slaked lime, and the best cleansed sand, in the proportion of $\frac{1}{4}$th lime to the whole mass. The lime should not be slaked, until instantly to be mixed with the sand; and as little water should be used as will make it like a paste: rain or soft water is most beneficial. When the mortar is mixed, and not to be instantly used, it should be kept entirely from the air; which rather improves than injures it: and when it is to be worked up it should be well beaten, and wetted sufficiently to make it work properly.

A little attention being paid to the foregoing remarks, will, if practised, prove of infinite service to the building, when erected. ARCHITECOR.

EARLY RISING.

The difference of Two Hours in the Morning.

THE difference between rising every morning at six and eight o'clock in the course of forty years (supposing the person should go to bed at the same time he otherwise would) amounts to 29,000 hours, or 3 years, 121 days, and 6 hours; so that it is just the same as if ten years of life were to be added, to which we might command eight hours every day for the cultivation of our minds in knowledge or virtue, or the dispatch of business. This calculation is made without any regard to the bissextile, which reduces it to 3 years, 111 days, and 15 hours; and, at eight hours a day, will want about a month of ten years.

EFFECT OF WINDMILL SAILS IN GRINDING CORN.

BY M. COULUMB.

WHEN a vertical windmill is employed to grind corn, the mill-stone makes 5 revolutions in the same time that the sails and the arbor make 1.

The mill does not begin to turn till the velocity of the wind is about 4 metres per second.

When the velocity of the wind is 5·8 metres per second, the sails make from 11 to 12 turns in a minute, and the mill will grind from 400 to 450 kilogrammes in an hour, or about 100,000 kilogrammes in 24 hours.

When the velocity of the wind is 9·1 metres in a second, the mill carries all her sails, makes 22 revolutions in a minute, and grinds 900 kilogrammes of flour in an hour, or 21,600 in 24 hours. With this velocity, the flour is heated to a considerable degree, and the millers change, from time to time, the kind of grain which is ground, in order, as they say, to refresh the mill.

To form Figures in Relief on an Egg Shell.—Delineate on the shell any figures you please, with melted tallow, immerse the egg in vinegar for near a week, when the figures will be quite plain.

E. G—y.

Walls.—A cohesive wall, supporting a bank of earth or a fluid with its vertical face, ought to be concave behind, in the form of a semi-cubical parabola, with its vertex at the top of the wall; but, if the materials be loose, the back of the wall should be an inclined plane.—*Emerson.*

THE CHEMIST.

ACTION OF THE CHLORATE OF ZINC UPON ALCOHOL.

BY M. MASSON.

THE author having dissolved chlorate of zinc in alcohol, submitted the liquid to distillation, taking precautions to examine the produce, and take exact note of its nature. He observed that when the liquid boiled it first lost its alcohol; but when the point of ebullition, which gradually rose, arrived at 130° or 140°, sulphuric ether was produced.

Thus the chlorate of zinc acts upon alcohol in the same manner as concentrated sulphuric acid; and, which is worthy of remark, it is at precisely the same temperature that each of these two bodies determine the production of sulphuric ether.

By increasing the temperature an oil is obtained, which exactly resembles the oil known by the name of sweet oil of wine; it is formed at the temperature of about 160°; that is to say, under the same circumstances which produce it from sulphuric acid and alcohol. It was also observed that the ether which was disengaged, was accompanied with a certain quantity of water; and the same was observed with the sweet oil, which was accompanied with a considerable quantity of water. These phenomena are also remarked in the reaction of sulphuric acid upon alcohol. M. Masson ascertained that, contrary to his expectation, no chlorhydric ether was produced.

It is thus proved, that the chlorate of zinc performs the same functions as sulphuric acid. It still remains to examine a number of phenomena, resulting from the reciprocal action of sulphuric acid and alcohol. The analogy observed by M. Masson between the chlorate of zinc and sulphuric acid is so perfect, that it can scarcely be doubted that the chlorate of zinc will furnish some substance corresponding with sulpho-vinic acid. This investigation is worthy of fixing the attention of M. Masson in his future experiments.

The author has not confined himself to establishing the identity of the oil he has produced with that procured by the aid of sulphuric acid. He has studied and analyzed this oil, and discovered that it is composed of two different substances; one, the most volatile, is liquid carburet of hydrogen, the most hydrogenated known; it is represented by $C^8 H^9$; it boils at about 30 or 40 degrees. The second, and less volatile, contains, on the contrary, less hydrogen than the olefying gas; it is represented by $C^8 H^7$, and boils at about 300 degrees.

These results, joined to those by which M. Regnault has demonstrated the absorption of oxygen gas by the light sweet oil of wine, will explain how certain chemists have obtained, in its analysis, more carbon than is contained in the olefying gas; and why others have, on the contrary, fallen upon the composition of olefying gas itself.

The reporter (Mr. Dumas), remarks that these facts, which appear to be well established, at first inclined him to consider M. Masson's experiments decisive of the question relative to the sweet oil of wine. But a German chemist, M. Marchand, has just published some analyses of the heavy oil of wine, and also some analyses of the light oil, and the crystals which it furnishes. His results agree perfectly with those of Sérullas; and, consequently, they differ from those which M. Masson has obtained, under the eyes, and in the laboratory of the reporter.

Amongst the chemists who have directed their attention to this subject, some have operated upon the oil obtained by sulphuric acid and alcohol, others by the oil of sulpho-vinates; and M. Masson has obtained his by alcohol and the chlorate of zinc; which may lead some chemists to think that these oils differ from each other, especially as M. Masson has never been able to extract from his oil the crystals which Sérullas and Marchand have obtained from their's; but has, on the contrary, extracted a volatile produce, unknown to the chemists who had preceded him. M. Marchand has undertaken to make this last difference disappear; for he mentions among the products of distillation of the sulpho-vinate, the existence of a very volatile body, which he has not analyzed, but which seems to bear a great resemblance to that discovered by M. Masson.

It is evident, then, that the history of the sweet oil of wine, is not yet terminated; but M. Masson has made a great progress in demonstrating the existence of a carburet of hydrogen extremely volatile $C^8. H^9$.

CURSORY REMARKS ON TOXICOLOGY.

No. II.

THE following directions for treatment of persons labouring under the effects of mi-

neral and vegetable poisons, are taken, *verbatim*, from William Buchan :—

Mineral Poisons—Arsenic is the most common of this class; and as the whole of them are pretty similar, both in their effects and method of cure, what is said with respect to it will be applicable to every other species of corrosive poison.

When a person has taken arsenic he soon perceives a burning heat and violent pricking pain in his stomach and bowels, with an intolerable thirst, and an inclination to vomit. The tongue and throat feel rough and dry, and, if proper means be not soon administered, the patient is seized with great anxiety, hiccuping, faintings, and coldness of the extremities. To these succeed black vomits and unhealthy evacuations from the bowels, with a mortification of the stomach and intestines, which are the immediate forerunners of death.

On the first appearance of these symptoms the patient should drink large quantities of new milk and salad oil till he vomits, or he may drink warm water mixed with oil. Fat broths are likewise proper, provided they can be got ready in time. Where no oil is to be had, fresh butter may be melted, and mixed with the milk or water. These things are to be drunk as long as the inclination to vomit continues. Some have drunk eight or ten English quarts before the vomiting ceased; and it is never safe to leave off drinking while one particle of the poison remains in the stomach.

These oily or fat substances not only provoke vomiting, but likewise blunt the acrimony of the poison, and prevent its wounding the bowels; but if they should not make the person vomit, half a drachm or two scruples of the powder of ipecacuanha must be given; or a few spoonfuls of the oxymel or vinegar of squills may be mixed with the water which he drinks. Vomiting must likewise be excited by tickling the inside of the throat with a feather. Should these methods fail, half a drachm of white vitriol, or five or six grains of emetic tartar, must be administered.

If tormenting pains are felt in the bowels, and there is reason to think that the poison has got down to the intestines, clysters of milk and oil must be very frequently thrown up, and the patient must drink emolient decoctions of barley, oatmeal, marsh-mallows, and such like. He must likewise take an infusion of senna and manna, or some other purgative.

After the poison has been evacuated, the patient ought for some time to live upon milk, broths, light puddings, &c., and drink barley water, or infusion of other mild mucilaginous vegetables.

Vegetable Poisons.—These, besides heat and pain of the stomach, commonly occasion some degree of giddiness, and often a kind of stupidity or folly. Persons who have taken these poisons must be treated in the same manner as for the animal or corrosive.

Though the vegetable poisons, when allowed to remain in the stomach, often prove fatal, yet the danger is generally over as soon as they are discharged. Not being of such a caustic or corrosive nature, they are less apt to wound or inflame the bowels than mineral substances. No time, however, ought to be lost in having them discharged.

An overdose of opium generally occasions great drowsiness, with stupor, and other apoplectic symptoms. Sometimes the person has so great an inclination to sleep that it is almost impossible to keep him awake. Every method must, however, be tried for this purpose. He should be tossed, shaken, and moved about. Sharp blistering-plasters should be applied to his arms and legs, and stimulating medicines (as salts of hartshorn, &c.) be held under his nose. It will also be proper to bleed him. At the same time, every method must be taken to effect the discharge of the poison: this may be done in the manner before directed.

The above advice is concise, clear, and extremely valuable; but when Buchan, in another place, recommends vinegar as a specific for *all* poisons, he commits a serious error; since if vinegar be administered to a person labouring under the effects of verdigris, it is thereby converted into a much more virulent poison, namely, soluble acetate of copper; and, further, we are assured by a celebrated oriental traveller, that when a Persian wishes to commit suicide, he swallows a piece of opium as large as a thumb, and drinks a glass-full of vinegar *directly* afterwards, by which he is thrown into convulsions, which terminate his existence. The word *directly* is printed in italics; because if the Persian were to swallow vinegar after the opium had passed from his stomach, and was exercising its narcotic properties on his frame, he would employ the best antidote with which we are acquainted; but swallowing it directly afterwards, causes its more rapid solution, and passage into his system, and consequently hastens its fatal effects. There is an old saying, "What's good at night, is bad in the morning," and this is an illustration of its truth. VANDERKISTE, JUN.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, Feb. 13, E. W. Elton, Esq., on the Genius and Influence of Shakspeare, with illustrations of his varied powers. —Friday, 15, E. W. Elton, Esq., in continuation. At half-past eight precisely

Tower Street Mutual Instruction Society.—Monday, Feb. 11, Mr. John Robinson—Question—What are the Uses of the Dead to the Living? At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, Feb. 12, — Wilson, Esq., on the Practice of Painting, Modelling, and Engraving. At half-past eight.

Poplar Institution, East India Road.—Tuesday, Feb. 12, General Meeting.—Friday, 15, Discussion.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 14, J. M. Leigh, Esq., on Eloquence and Elocution. At half-past eight.

Society for Promoting Practical Design, Saville House, Leicester Square.—Monday, Feb. 11, Geo. Foggo, Esq., on Composition. At a quarter past eight.

London Temperance Institute, 167, Fleet Street.—Friday, Feb. 15, Mr. George Brimmer, on the Diffusion of Scriptural knowledge.

ANSWERS TO QUERIES.

To the Editor of the Mechanic and Chemist.

Cheap Stoves.—Sir,—In reply to "A Subscriber" on cheap stoves, I beg to furnish him with an account of one that I have had fixed, and which has succeeded to the fullest extent of my anticipations: it is 36 inches high by 14 square, made on Arnott's principle, with the addition of an oven and boiler; the former being 12 inches long, by 7½ deep, and 9 wide; so constructed, that a space is left at the back and two sides (within the sheet-iron case) to admit heat to the copper boiler above, which holds nearly two gallons of water, admitted by an opening at the top, 3½ inches over, with a counter-sunk cast-iron lid: to the most pendant part of the boiler is a brass tap. Besides the advantage arising from a constant supply of boiling water, may be enumerated the beneficial effect of the steam, which is not more that sufficient to neutralize the dry heat of a closed apartment. The oven is at all times hot enough for most domestic purposes, and cooks infinitely better than those in ordinary use. The fuel I have used has been coke; supplied at the time of lighting, and twice during fourteen hours, at an average cost of 2¼d. or 2½d. for that time: this is with my shop-door open; but in a room not requiring the door open, 1½d. of fuel for 12 hours would be amply sufficient to give a heat of 60 or 70 degrees Fahrenheit. The price of mine was six guineas. However others may be disposed to dispute priority of invention with Dr. Arnott, I think him fully entitled to our highest meed of gratitude for the disinterested manner in which he has given publicity to so great an improvement. At any rate he has the best thanks of

CHEMICUS.

To find the Diameter of a Circle.—Sir,—I beg to inform "Electron" that the following rule for finding the diameter of a circle when the lengths of the chord and versed sine are given, is in No. 94 of this work:—" Divide the square of half the chord by the versed sine, to the quotient of which add the versed sine, and the sum will be the diameter." For more directions, and an example, see the above-mentioned numbers. I am, yours, &c.,

F. P.

Blue Dye.—Sir,—I beg to to inform "W. Y. Z." that woad contains a colouring matter similar to indigo; and is used as a vegetable ferment in dying blues, and lime as the solvent of the green base of the indigo. When the cloth is first taken from the vat, it is green in colour, but quickly becomes blue by attracting oxygen from the air: after which it is thoroughly washed. This solution is liable to run too quickly into the putrid fermentation, but is remedied by adding more lime. The fermentation is sometimes too languid, which is obviated by adding more woad to diminish the proportion of quick-lime.

I am, your's, &c. F. P.

To Solder Copper and Zinc.—Sir,—I beg leave to inform "B. R. S." in No. 121, that he may solder copper wire to zinc, by using spirits of salts as a flux; first tinning the copper wire, which he may do by using resin with the solder.

F. JONES.

A Test for Steel.—Let fall a single drop of nitric acid on any cutting or other instrument supposed to be steel. If steel, the part whereon the drop fell will immediately turn black. No effect will, for a considerable time, take place if the acid he dropped on pure iron. The blackening of the steel is owning to the combination of its iron with the acid, and the consequent precipitation of the carbon.

N. R.

QUERIES.

Sir,—Can any of your readers inform me how I can make acetic ether. I have tried to get it at several chemists, but failed.

N. R.

Sir,—Can you, or any of your Correspondents, inform me how to make oxygen gas; also whether you can inform me how to make chlorate of pottash, and which is the cheapest place to buy tin-foil and mercury; also, to clean brass for lacquering.

J. JONES.

Sir,—How can varnish be removed from the surface of an oil painting, without injuring the picture? The insertion of the above will be esteemed a favour, as I have a valuable painting on wood which I wish to restore.

AN AMATEUR.

Sir,—Can you, or any of your readers inform me, which metal is the cheapest, zinc or tin, in the sheet. Also, the gum or glue use by modellers in cardboard.

H. E. T.

TO CORRESPONDENTS.

"W. N." *may see some Cyclopœdias, which will probably answer his purpose, by applying at No. 4, Bounden Row, Blackfriars Road.*

W. P. *can grind the edges of glass slips on a smooth flagstone with water; the watch-glass makers use a plate of iron, which is less liable to chip the glass. A diamond for cutting glass should be firmly held by the metal in which it is set; shell lac is the best cement for such purposes, but not strong enough without some other fastening. With respect to his other query, "how to pick out a good penknife," it may be inferred in some measure from the goodness of the workmanship, that the quality of the steel is also good; but the only sure method of ascertaining the quality and temperature of the steel is by trial.*

J. S *The story of internal fire in the earth is fabulous; there is no circumstance to support that assertion, the increase of temperature in deep mines being no greater than must necessarily result from the increased density of the air. It is not pretended, even by the inventors of this imaginary fire, that it has any connexion with the phenomena of volcanoes.*

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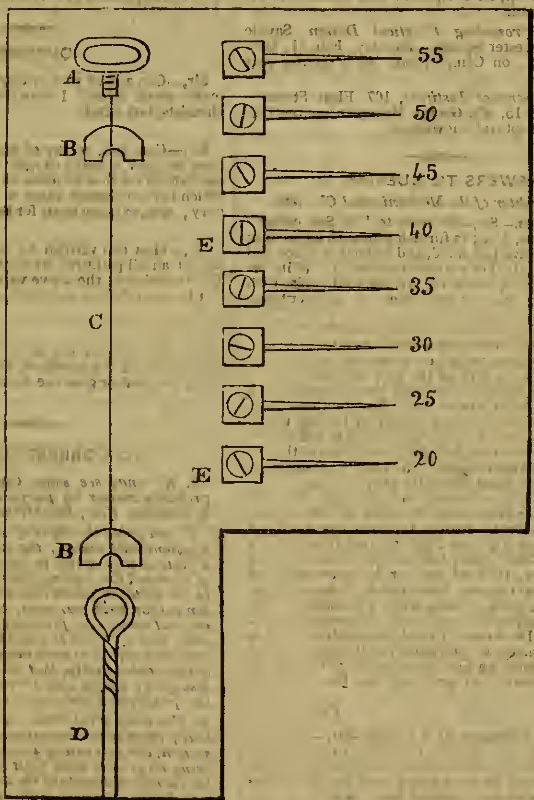
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. VII. NEW SERIES. | SATURDAY, FEB. 16, 1839. (PRICE ONE PENNY.) | No. CXXVIII. OLD SERIES.



MUSICAL THERMOMETER.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

MUSICAL THERMOMETER.

THE construction of this instruction is as follows:—D is a brass wire, about 1-16th of an inch in diameter, and 3 feet in length; one end is fixed to a stout deal board (a part only of which is shown in the engraving), and to the other end is attached another wire, C, which is very much thinner than D, and is supported on two bridges, B B, placed two or three inches apart, and fastened to the peg A, by means of which it may be turned to any required pitch. E E are steel springs, producing sounds which do not perceptibly vary under any circumstances of heat or cold. When any variation of temperature causes a corresponding alteration in the length of the wire, D, the smaller wire, C, opposing much less resistance than D, becomes tighter or looser, according to the expansion or contraction of the long wire D; so that the pitch of the vibrating part C, is very sensibly altered, when the effect would be imperceptible in a continued wire of equal thickness.

The string, C, being tuned to the fixed pitch of one of the springs, at the temperature which it represents, it is evident that any alteration in C may be detected by comparing it with the sound of that spring; and the scale may be continued to any extent, the spring, whose sound corresponds with that of the string, C, always indicating the temperature.

When the instrument is newly adjusted it soon gets out of tune; but, after a time, it will continue to act with tolerable accuracy for a considerable time without tuning. It cannot, of course, be expected that this thermometer possesses the accuracy of one of the ordinary kind, but it possesses some peculiarities, and indeed, some advantages, which render it not entirely uninteresting. It possesses the property of exhibiting a sudden change of temperature more promptly than any other instrument. When the tone was raised by placing it at the window of a warm apartment, it descended about half a semi-tone, before it could be carried back into the middle of the room. It is also a circumstance worthy of notice, that it may be consulted by a blind person. For the information of mares' nesters, it will, perhaps, be as well to state that this instrument was noticed some time ago in a foreign work; and that notice was derived from the same source as the present communication.

Q. E. D.

ORIGIN OF DECIMAL NUMERATION.

AT the meeting of the French Academy of Sciences (Jan. 21), M. Chasles addressed a note upon the period at which the system of numeration by figures, having a value of position, was first known in the west, and the people to whom we are indebted for that great invention. With regard to the latter point, it has been generally believed that it was received from the Arabs, who borrowed it from the Greeks; but different opinions were entertained respecting the precise period of its introduction, some thinking that Leonard Fibonacci, of Pisa, first taught this method in his treatise on the abacus, in the year 1202; others suppose it to have been introduced into France by Pope Sylvester II., who brought it from Spain. Besides these two predominating opinions, there is another, which ascribes to the Greeks the honour of the invention. This opinion is supported by a passage of Boece, who describes a system of numeration, which he attributes to Pythagoras, and which it is maintained is identical with our present system. Most of those who have applied themselves to the investigation of this question, are nevertheless of opinion that the words of Boece do not relate to our system of numeration, especially to the ingenious principle of the value by position, which constitutes its principal merit; but they agree that the Romans might have had some signs of abreviation, such as the notes of Tiro, for writing great numbers; and that the passage in Boece may refer to something of that kind. This passage being very obscure, has left an ample field for interpretations. M. Chasles announces that he has obtained a literal explanation from the text of a manuscript more correct than the editions of 1492 and 1570, and has arrived at the following conclusions:—

1st. That the table of Pythagoras, *mensa Pythagorica*, mentioned by Boece, and which the moderns have called *Abacus*, is not the table of multiplication, as hitherto supposed.

2nd. That the word *Abacus*, as employed by Boece, signifies a particular table, prepared for the practice of arithmetic, according to the system of numeration of which he speaks.

3rd. That this system reposed upon three principles; the decimal or ten-fold progression, the use of nine figures, and the value of those figures, changing with their position.

So that the system of Boece differs from our own in only one point, the absence of

the zero. The deficiency of this auxiliary figure was supplied by the use of columns traced upon the table, which, by showing distinctly the different orders of unity, admitted a space to be left wherever we place the zero.

M. Chasles endeavours to prove that this system of numeration was preserved during several centuries, assuming the name of *Abacus*, which Boece only applied to the table, by means of which the operations were performed. According to M. Chasles, this system is identically the same as that which was cultivated in the tenth and eleventh centuries by Gerbert (Pope Sylvester II.) and his disciples. Admitting this point as decided, another question still remains to be resolved. Was the zero introduced to supply an obvious defect in the system of the *Abacus*, or was it borrowed from the arithmetic of the Arabs? M. Chasles thinks that the disciples of Gerbert took the idea of this auxiliary figure probably from the sexagesimal arithmetic of the Greeks and Romans, where the zero is employed to mark the place of degrees, minutes, and seconds, which is wanting in the expression of an astronomical number. This he considers as proved, by the result of his researches, in three manuscripts in the library of Leyde.

M. Chasles had remarked in a manuscript in the library of Chartres, the zero placed after the nine figures, in two instances; first, in the table of Boece; and next, in another writing upon the system of the *Abacus*. In this writing he found nine verses, expressing the names and values of the nine figures. The word *sipos* appeared in the ninth verse, but in the text this number always bears the name of *celentis*. This circumstance suggested the idea that the ninth verse should apply to zero, from which it would appear that it was originally called *sipos*. The signification of the verse "*Illinc sequitur sipos qui rota namque vocatur,*"* seemed to confirm the conjecture, since the designation of "wheel," applied to the form of zero, and not to that of the figure nine; but a circumstance, which has much more weight is the existence of a manuscript in the library of Lyepe, wherein this same passage of Boece, the name *celentis* is applied to the nine, and *sipos* to the *zero;* and in this manuscript there are ten verses instead of nine.

It is then proved, according to M. Chasles, that the zero was introduced into the system of the abacus, under the name of *sipos*, that consequently the name of *cifra*, which it afterwards obtained, and which has been set forth as a decisive proof that it was derived from the Arabic word *syfr* (empty, nothing), does not possess the importance which has been attributed to it. Thus, remarks the author, "the zero, is incontestably the Greek form, since, as we have seen, the Greeks, in the sexagesimal arithmetic, took their omicron for the auxiliary figure (while the Arabs had a point for the same use, and employed a small circle for their figure five); the zero has its first name, *sipos*, derived from the Greek."

(To be continued.)

* "Whence follows sipos, which is called a wheel" *Sipos*, apparently corrupted from *sipho* or *sipo*, signifies a tube or hollow vessel; but M. Chasles derives it from *chephos*, a counter (round, or circle.)

THE GREAT WESTERN RAILWAY.

To the Editor of the Mechanic and Chemist.

Sir,—I take the liberty of calling your attention to an article, signed "A Boston C. E." in the enclosed publication. I readily admit that you can well afford to "pass over a little impertinence from interested contemporaries," but the article I have alluded to is so scandalously dishonest, that I think, in justice, it ought to be exposed. I remain, Sir,

Your obedient Servant, Q. E. D.

It is with some degree of hesitation and reluctance that we devote even this small space to the consideration of so miserable a production. The writer, after a little preliminary jactance, proceeds to state that he had found this sentence in our article on the Great Western Railway:—"Messrs. R. Stephenson and Co. and Mr. Bury, have expressed their conviction of the superiority of the wide gauge." By referring to our article, it will be seen that we have stated nothing of this import, and that therefore the assertion of "E. Boston, C. E." can only be properly designated by that monosyllable, the contrary of which is the truth. The letters of Messrs. Stephenson and Co. and Mr. Bury, are then produced. Mr. Bury says, "there is no doubt an addition to the present width (4ft. $8\frac{1}{2}$ in.) would enable us to make a more perfect engine. The addition of six inches would be ample, and I consider anything beyond that would tend to increase the difficulties beyond what we now experience, rather than otherwise."

Messrs. Stephenson and Co. say, "In our early engines an additional width of three or four inches would have facilitated

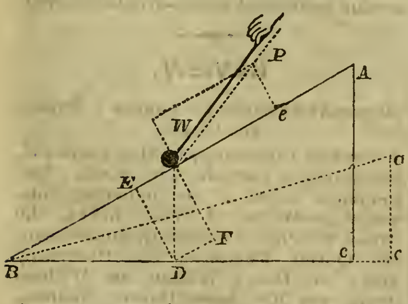
the arrangement of the working gear and eccentrics; but this has since been simplified, and our latest arrangements of those parts leave scarcely this small increase of width to be wished for." From which it plainly appears, that though they do not approve of the wide gauge (that is, the 7 feet, adopted by Mr. Brunel), they both acknowledge that some increase of gauge would be desirable We will now transcribe what we really did say:—" The opinions of two of the largest manufacturers of locomotives in the kingdom, Mr. Edward Bury and Messrs. Robert Stephenson and Co., are in favour of *an* increased width of gauge, but they think seven feet a greater width than is necessary." If "A Boston, C. E." had written to us like an honest mare's nester, we should merely have told him that he was mistaken, and he would have avoided this unpleasant exposure.

ON THE MECHANICAL POWERS.

NO. VI.

THE INCLINED PLANE.

The inclined plane is the most simple of all machines. It is a hard plane surface, forming some angle with a horizontal plane, that angle not being a right angle. When a weight is placed upon such a plane, a two-fold effect is produced. A part of the effect of the weight is resisted by the plane, and produces a pressure upon it, and the remainder then urges the weight down the plane, and would produce a pressure against any surface resisting its motion placed in a direction perpendicular to the plane. Let A B be such a plane, B C its horizontal base, A C is height, and A B C its angle of elevation.



Let W be a weight placed upon it. This weight acts is the direction W D, and is equivalent to two forces, W F perpendicular to the plane, and W E directed down the plane. If a plane be placed at right angles to the inclined plane below W, it will resist the descent of the weight, and sustain a pressure expressed by W E. Thus, the weight W resting in the corner, instead of producing one pressure in the direction W D, will produce two pressures, one expressed by W F upon the inclined plane, and the other expressed by W E on the resting plane. The pressures respectively have the same proportion to the entire weight, as W F and W E have to W D, or as D E and W E have to W D; because D E is equal to W F. Now the triangle W E D is in all respects similar to the triangle A B C; therefore the three lines A C, C B, B A, are in the same proportion to each other as the lines W E, E D, and W D. Hence A B has to A C the same proportion as the whole weight has to the pressure directed toward B, and A B has to B C the same proportion as the whole weight has to the pressure on the inclined plane. Suppose the weight to consist of as many pounds as there are inches in A B, then the power requisite to sustain it upon the plane will consist of as many pounds as there are inches in A C, and the pressure on the plane will amount to as many pounds as there are inches in B C. The less the elevation of the plane, the less will be the power requisite to sustain a given weight upon it, and the greater will be the pressure. Suppose the inclined plane A B to turn upon a hinge at B, and to be depressed so that its angle of elevation shall be diminished, it is evident that as the angle decreases, the height of the plane decreases, and its base increases. Thus, when it takes the position B *a*, the height *a c* is less than the former height A C, while the base B *c* is greater than the former base B C. The power requisite to support the weight upon the plane in the position B *a* is represented by *a c*, and is as much less than the power requisite to sustain it upon the plane A B, as the height A C is is less than the height *a c*. On the other hand, the pressure upon the plane in the position B *a* is much greater than the pressure upon the plane B A, as the base B *c* is greater than the base B *c*. Roads which are not level may be regarded as inclined planes, and loads drawn upon them in carriages, considered in reference to the powers which impel them, are subject to all the conditions which have been established for inclined planes. The inclination of the road is estimated by the height corresponding to some proposed length: thus it is said to rise one foot in ten, one foot in twenty, &c.; meaning that if ten or twenty feet of the road be taken as the height of an inclined plane,

such as A B, the corresponding height will be one foot. On a horizontal plane, the only resistance which the power has to overcome is the friction of the load with the plane, and the consideration of this being omitted, a weight once put in motion, would continue moving for ever, without any further action of the power. But if the plane be inclined, the power will be expended in raising the weight through the perpendicular height of the plane. Thus, in a road which rises one foot in ten, the power is expended in raising the weight through one perpendicular foot for every ten feet of the road over which it is moved. If the power act obliquely to the plane it will have a two-fold effect, a part being expended in supporting or drawing the weight, and a part in diminishing or increasing the pressure upon the plane. Let W P be the power, this will be equivalent to two forces, W *f* and W *e*. In order that the power should sustain the weight, it is necessary that that part, W *e*, of the power which acts in the direction of the plane, should be equal to that part, W E, of the weight which acts down the plane. The other part, W F, of the power, acting perpendicular to the plane, is immediately opposed to that part, W *f*, of the weight which produces pressure. The amount of power which will balance with the weight may be found as follows:—Take W *e*, equal to W E, and draw *e* P perpendicular to the plane, and meeting the direction of the power. The proportion of the power to the weight will be that of W P to W D; and the proportion of the pressure to the weight will be that of the difference between W F and W *f* to W D. If the amount of the power have a less proportion to the weight than W P has to W D, it will not support the body on the plane, but will allow it to descend; and if it has a greater proportion it will draw the weight up the plane.

A. D. M.

STEAM CARRIAGES ON COMMON ROADS.

To the Editor of the Mechanic and Chemist.

SIR, — Your correspondent, "T. S. Brown," has betrayed an antipathy to railways, which, within measured terms, is not in consonance with the general opinion of the scientific part of the public. The time has been, when attempts to discover "perpetual motion" were persevered in with more zeal than prudence. Few persons are, I believe, at this date, prone to indulge in such warfare with the laws of nature. I apprehend we are not far distant from the period when any proposition to propel carriages upon common roads, upon a rugged surface, irregular in section, and tortuous in direction, will be viewed with as much indifference as we now look upon the once favourite "whistle" perpetual motion. Nature has made known to us a few of her laws; they are undeviating, immutable. Thus inexorable, it is our duty to make them available to the purposes of our wants, and to avoid them in the shape of antagonists. Principles have been derived from a knowledge of these laws; and two of their leading features, in reference to roadways, consist in an adherence, in section, to the horizontal line, and in a strict observance of the rectilineal direction. These are indisputable facts, and I wish "Mr. Brown" may reconcile them with his notions of "turning corners."

I remain, your's, respectfully,

Q.

Bristol and Exeter Railway.—Within the last few months coffer dams have been driven preparatory to the erection of a bridge, 100 feet span, over the river Paret, about three-fourths of a mile higher up that river than the town of Bridgewater. The contractor is now employed in building the abutments, and the arch will be turned in the latter end of the spring, when the work towards Taunton will be begun immediately. The cutting at Pariton Hill is proceeding with much vigour, upwards of 500 men are employed on it at present, and more will be shortly. This is the only hill for many miles, and as soon as it is got through (which, if the Company go on at the rate they have begun), will be soon, nothing remains but to lay the permanent rails.—*Bristol Journal.*

REVIEW.

Biography Illustrated. London: Darton and Clark.

A PRETTY little work, by Mrs. Sherwood, containing a portrait, with a short biographical sketch of the following individuals:—Martin Luther, Elwes, the Miser, Sir Joshua Reynolds, Zimmerman, the Queen Charlotte, Sir Humphrey Davy, Sir Henry Wotton, Sir William Jones, the Rev. James Harvey, Addison, Lord George Lyttleton, and Lady Jane Grey. The well-known talents of the editor renders any commendation on our part unnecessary.

GREAT WESTERN RAILWAY.

One of the half-yearly general meetings of the proprietors of the Great Western Railway Company was held, on Tuesday, at the Company's offices in Princes-street, City, Mr. W. U. Sims in the chair. The chairman having stated the object of the meeting, called upon the secretary to read the report, and said that he (the chairman) should be ready to give any information in his power which the report might be found not to contain. The secretary then proceeded to read the report, from which it appeared that the number of passengers taken by the company, from the 4th of June to the 31st of December, was upwards of 264,000, or 1,278 per diem. The receipts during that time had been 43,845*l.* 2s. 2d., and the expenditure 25,548*l.* 16s. 6d., leaving a net profit of 18,296*l.* 6s. 8d. The report stated that the short trains were very expensive, and that the high price of coke, which could only be procured in London, rendered the outlay of the company much greater than it otherwise would be. This railway ranked, in point of the number of passengers conveyed, next to the Birmingham and Liverpool. The mails and many of the coaches were still on the turnpike road, but when a greater proportion of the line was completed, there would be an accession of profit from these sources, and every effort would be made to extend the line with as little delay as possible. The eastern arch of Maidenhead Bridge had been rebuilt by the contractor, and would be ready to open in a few weeks. The report congratulated the proprietors on the Lord Chancellor's decision in favour of their Slough terminus, which had been opposed by Eton College, and stated that the inhabitants of Windsor were desirous that a branch should be carried into that town. This the directors were of opinion would increase the traffic considerably, as well as open the communication to Egham, Englefield, and other places. They still entertain hopes of succeeding in procuring a bill for an extension of a branch line to Oxford, although their bill was thrown out of Parliament last session, through the opposition of the University and corporation interests. The report was unanimously adopted, and the meeting, in all respects, was of a highly satisfactory nature.—*Times.*

City Improvements.—We understand it is intended to remove the whole of the houses in that filthy place, miscalled *Field* Lane.

NEW LOCOMOTIVE ENGINE.

We have received a letter from a friend in America, calling our attention to a new locomotive engine calculated to ascend an inclined plane, a model of which he has seen. The following is a brief account of it, so far as the inventor will at present allow it to be made known; for it appears he has not procured a patent for it. It is described as a locomotive engine of eight or ten tons weight, cylinder 12 by 18 inches, of ordinary construction. In ascending or descending inclined planes, the driving wheels are raised from the ordinary track, and the locomotive is partly sustained on small wheels (well represented by the ordinary hubs of a carriage,) on raised rails each side of the track two feet high. The invention consists in a mode of gaining adhesion, which can be increased to any extent with very little increase of friction. The power being transferred from the large driving wheels to small ones, the velocity will of course (in ascending) depend upon the steepness of the ascent, which will regulate the size of the small wheels. We calculate, according to Pambour, to ascend a plane of 200 feet rise in the mile, at the rate of four miles the hour, with 100 tons burden. The apparatus to gain the adhesion cannot add 300 dollars to the cost of the locomotive; it is never in action except when overcoming inclined planes; will last longer than the locomotive, is simple, easily managed, and not at all liable to get out of order. The expense of the raised rails will depend upon the materials used in their construction, which may be of wood or iron. Two hundred feet in the mile is the maximum of ascent recommended; but by reducing the velocity and load, 400 or more may be overcome. The apparatus is within the locomotive, which, with the raised rails, constitute all that is necessary to overcome the ascent. There will be no time lost in commencing the ascent. —*Scotsman.*

Mortices.—A mortice-hole should be taken out of the middle of a beam, not from one side; but if it be on the concave side, and filled up with hard wood, it does not diminish the strength. For similar reasons, a piece spliced on, to strengthen a beam, should be on the convex side. If a cylinder is to be supported at two points with the least strain, the distance between the points should be ·5858 of the length.—*Emerson.*

CURSORY REMARKS ON TOXICOLOGY.

No. III.

One of the most terrible of the animal poisons, is that of a mad dog. It would be futile to describe its symptoms, since they, alas! are too well known. We are assured by Tramper, in his travels through Africa, that his carpenter having been bitten by one of his dogs in a state of hydrophobia, and not knowing what to do with him, it being impossible to carry him through that wilderness, and believing his case hopeless, he determined to bleed him to an extent never, perhaps, equalled by any medical practitioner; and, if he found that fail, to repeat the operation until death put an end to his sufferings. He was surprised, however, to find that, in proportion as he bled, the man recovered health and spirits; and a few doses of briskly purgative medicine completed the cure. Bleeding has, unhappily, not been attended, in this country, with the like success. Possibly through its not being carried to a sufficient extent, or the dissimilarity of climate, may be the cause of its failure.

Desperate diseases require desperate remedies. And the experiment of excessive bleeding might first be made on a rabid quadruped; but even if it should fail in that case, I would still recommend its trial on man; for quadrupeds are sometimes not at all affected by the same poisons which are fatal to the human race. Poor Chunee, the elephant that was shot to death, at Exeter Change, was made to drink three ounces of prussic acid in a bottle of brandy; which did not produce the slightest effect. A few drops would be sufficient to destroy a man.

Although assertions have been made to the contrary, it is generally believed, that a decided case of hydrophobia has never yet been cured, in this country. It has completely baffled medical science; and the physician sees all his attempts fail, and the patient sinks into an untimely grave, in the face of his utmost endeavours.

On examining the body of a dog that died in a rabid state, Mr. Shipman found the interior of the stomach extensively ulcerated; the whole of the mucous membrane (lining) of that part, presented one uniform surface of a highly inflammatory condition, much thickened in many parts, and discoloured, as though in a sphacerated (mortified) state. The œsophagus (part of the passage from the throat to the stomach), was considerably contracted, especially at the upper portion; and the larynx (upper part of the windpipe), manifested, that inflammation had likewise existed there. The vessels of the brain were preternaturally injected with blood, likewise those of the membranes enveloping that structure; and the same condition was observed to have taken place down the course of the spinal marrow. The gall-bladder (a receptacle situated under the liver, in which it is attached), did not contain a particle of bile: and the rest of the viscera (internal parts) appeared perfectly healthy.

Dr. Barth, a German physician, in his work, entitled "Medical Observations", mentions the extraordinary case of a man, forty years of age, who was attacked with the symptoms of hydrophobia, from checking the perspiration of the feet. The patient was habitually subject to this inconvenience, in an extraordinary degree; and, on one occasion, after bathing the feet in cold water he was attacked with spasms and contraction of the throat. An infusion of elder flowers, which he attempted to swallow, was rejected with violence; at the same time, the outside of the throat swelled excessively, and a suffocating rattling took place. This effect was renewed whenever a liquid was approached to the mouth. Mustard poultices applied to the chest and calves of the legs, an anodyne lavement, and a bath of hot water, heightened by salt and cinders, provoked a general perspiration; and the patient recovered.

The general mode of treatment for hydrophobia, is bleeding and other evacuations, the use of antispasmodic medicines, mercury, &c., and bathing. If the wound be made in a part that can be safely cut out, the knife should be used as quickly as possible. Vanderkiste, Jun.

DAGUERRE PICTURES.

At a recent meeting of the Royal Society, a memoir was read from Mr. Talbot, in which he claims the invention of producing permanent pictures from the camera obscura. It does not, however, appear that he is in possession of the secret of M. Daguerre, as his pictures are not true representations, like those of M. Daguerre, but reversed; that is, the parts where the light falls becomes dark, and the shaded parts remain white. We mentioned in our last number, that the idea of forming pictures by the action of light was not new; but the substance employed by M. Daguerre, we believe to be a secret known only to himself.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Friday, Feb. 22, E. W. Elton, Esq., in conclusion. At half-past Eight, precisely.

Tower Street Mutual Instruction Society.—Monday, Feb. 18, Mr. George Watson, Lecture on Music, with Vocal and Instrumental Illustrations. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, Feb. 19, Dr. John Walker, on Indigestion. At half-past Eight.

Poplar Institution, East India Road.—Tuesday, Feb. 19, Mr. Johnson, on Botany.—Friday, 22, Discussion.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 21, Basil Montagu, on Female Affection, and Female Character. At half-past Eight.

Society for Promoting Practical Design, Saville House, Leicester Square.—Monday, Feb. 18, B. R. Haydon, Esq., on Painting. At a quarter past eight.

London Temperance Institute, 167, Fleet Street.—Friday, Feb. 22, W. G. White, Esq., on Meteorology, in continuation. At Eight.

ANSWERS TO QUERIES.

To the Editor of the Mechanic and Chemist.

Oxygen Gas.—Sir,—I beg to inform "J. Jones" that he can obtain pure oxygen gas from manganese after the following manner:—The oxide of manganese of commerce, or otherwise the peroxide of manganese, is very seldom found free from carbon. There are two tests to discover this: first, which is, however, not the most certain, generally the peroxide of manganese, which is crystallized in shining needles is not carbonated; secondly, reduce the peroxide to powder, and pour on it some nitric acid: if it is carbonated, an effervescence will take place immediately. If the chemist, therefore, wishes to employ such an oxide, he should previously agitate it in an earthen vessel with an excess of diluted muriatic acid. The carbonic acid gas is set at liberty; and as soon as the effervescence is finished, the chemist has only to pour out the liquid, to wash the oxide once or twice with a great deal of water, and then to dry it: it is afterwards fit for use, and will produce very pure oxygen. Without this previous step, on the bottle being heated to a high temperature, the carbonic acid gas would be disengaged during the operation, and would render the result very different from what was expected. W. N.

Ether.—Sir,—I beg to inform "R. N." that the formation of ether consists simply in subtracting from the alcohol a certain proportion of carbon: this is effected by the action of the sulphuric, nitric, or muriatic acids, on alcohol. The acid and carbon remain at the bottom of the vessel, whilst the decarbonized alcohol flies off in the form of a condensed vapour, which is ether. S. S.

QUERIES.

Sir,—Observing in No. 120 of your magazine a short account of a "Cheap Galvanic Battery," not having any knowledge of the construction of galvanic apparatus, and feeling a great interest in the science, has induced me to request your kind correspondent "W. C." to give a fuller and more minute description of his battery; the account there given being so general, as to be understood only by those fully acquainted with the art; the points on which information is particularly requested, are, how are the zinc and copper coils to be joined, their size; how and where the wires are to be attached; how are the divisions to be connected; and what are the principal causes of failure? Also, could you inform me of any moderately cheap work on galvanism; such an one as contains the practice of the science, with information likely to be useful to a learner.

AN AMATEUR CHEMIST.

Sir,—Would you have the kindness to inform me, through the medium of your valuable periodical, how I can obtain a composition that will give a purple flame for fire-works; it must not be a liquid.

J. GEORGE.

Sir,—I should feel greatly obliged if any of your numerous correspondents could inform me how to whiten bone that has lain under ground for some time; likewise, how I can obtain skeletons of small animals.

R. S., HOLBORN.

Sir,—Will you, or some of your correspondents, be good enough to answer the following queries:—To what pressure may I, with safety, raise steam in a small boiler of cast brass full one-eighth of an inch thick; and in another (same size) of sheet brass one-sixteenth of an inch thick? The cast boiler is square, and in two pieces, flanched together; the other is waggon-shaped, and in four pieces, the bottom rivited, and ends hard soldered together. Also, what pressure in pounds per square inch would be required to raise a valve, the diameter of which is a quarter of an inch; weight, two ounces six pennyweights; leverage from valve to end, seven times from valve to fulcrum? Also, another the diameter of which is three-twentieths of an inch; weight, one ounce three pennyweights; leverage, the same? Perhaps Q. E. D. will be good enough to calculate these. Likewise, the construction of Dundonald's rotary steam-engine, working at the Polytechnic Institution.

THOMAS BAILEY.

Sir,—I should feel obliged if you would insert the following optical question in your magazine:—What is the greatest distance at which the human eye can, under favourable circumstances, discern the hands and figures of a church clock, the diameter of which is three feet, so as to tell the exact time?

A. D. M.

TO CORRESPONDENTS.

G. Nash. *We have already stated that the invention of M. Daguerre is not yet divulged; our correspondent's idea of applying this process to astronomical purposes, by examining the images formed on the paper, with a microscope, would not succeed; the delineation, though admirable as a picture, is not, and cannot, be near perfect enough to exhibit microscopic details.*

R. S. L. *The Index, Title, &c. of Vol. III., with Frontispiece, is now published.—The acid and alkali will test each other: when the two solutions are brought in contact with each other a visible and audible effervescence takes place during the process of neutralization. The alkalies possess the property of saponifying oil and grease. The rest will be inserted.*

J. B. *The reason why a particular paper is called* foolscap *is, that it formerly bore the water-mark of a fool's head and cap with bells. This costume was found necessary when great people kept fools in their establishments, to distinguish the professional from the natural ones.*

A Subscriber. *An article will shortly appear in this work on the subject of his inquiry.*

Formator. *The passage which we omitted in his paper on phrenology we did not consider objectionable in itself in the slightest degree, but we were fearful that it might lead to a controversy which, in less discreet hands than his, might involve a discussion incompatible with the tenor of this work.*

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THE

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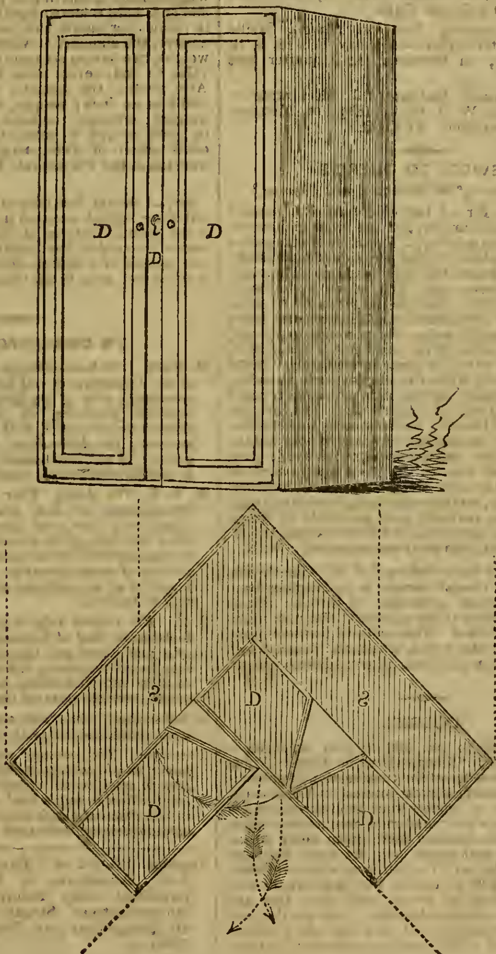
CURIOUS PAPER PRESS IN THE SOCIETY OF ARTS.



City Press, 1, Long Lane, Aldersgate Street; D. A. Doudney.

CURIOUS PAPER PRESS.

(See Engraving front page.)

To the Editor of the Mechanic and Chemist

SIR,—Thinking it would be interestin g and useful to your readers, I have sen t you a sketch of a press for keeping papers in, which I observed, a short time since, at the Society of Arts in the Adelphi, Strand. I was struck with its extreme compactness, there being scarcely any room lost. It is so constructed, that it may be *built into* an angle of the room, and only the panelled doors be visible. S S are shelves; D D are doors, fitted with shelves inside. The arrows show the manner the doors open, and although they cannot of course be opened all at one time, by being thrown back at separate times, they open to vie w every part of the closet. The hinges are shown black. The only room wasted is left white in the plan. The sketch is drawn to an half-inch scale. FORMATOR.

BUILDING.

NO. II.

THE next object worthy our notice, before commencing the building, is the choice of the bond of which the structure is to be erected. The ancients practised on six different kinds of walls; the first, termed reticolata, or net-work; the second, quadrels, or brick; the third was composed of rough stones; the fourth of various assortments of stones; the fifth of smooth stones; and the sixth, called riempiuta, or coffer-work. But as they are now totally abolished, and will, in all probability, never again be commonly practised in this country, it would be useless my occupying any greater space in describing them; I shall, therefore, now commence describing the two bonds now in general practice, English and Flemish. By the term "bond" in brickwork, is meant the arrangement which causes the bricks in the upper course to cover the joints of those in the course below; consequently, in a manner tying them together. English bond is composed of alternate courses of headers and stretchers, so placed that the stretchers cover the joints of the headers below; and that no joint is allowed to recur perpendicularly directly over one another. Fig. 1 represents the plan of a brick-and-a-half wall on a *header;* and

(FIG. 1.)

(FIG. 2.)

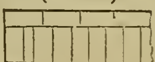


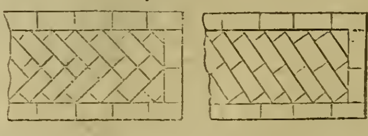
Fig. 2, likewise the plan of a wall, of the same thickness, on a *stretcher*, built after this system; allowing four inches and a half for the stretcher, and nine inches for the header — making together thirteen inches and a half, which would be more correct, but is technically described as being fourteen inches thick. But if the brickwork is commenced from a vertical angle, every alternate joint in a course of headers, will fall over the joints between the stretchers. This evil is remedied by cutting a brick longitudinally into two, or transversely into four equal parts, and placing one of them next a whole header, as at A, in Figs. 1 and 2; and when the next header is properly placed, it will overlap the joint between the stretchers, and which overlap can be preserved throughout. These parts of bricks are called *closers.*

Flemish bond consists of headers and stretchers alternately in the same course. Here the diagram shows the plan of a brick-and-a-half wall, and which sufficiently explains itself.

(FIG. 3.)

It is a fact, that if a brick can possibly be worked whole, it ought not to be cut; but in the case before mentioned, it is absolutely necessary that they should be; for without the presence of closers, no bond would be effected. Parts of bricks will occasionally occur in these bonds, but more frequently in the Flemish; and for this and other reasons, the Flemish is more objectionable than the English bond, inasmuch as it does not produce so perfect a transverse tie. Where strength is the chief object, or where the wall is to be stuccoed, I should recommend the English as far preferable to the Flemish, although in thick walls it is generally supposed that the latter has been much improved by the introduction of raking courses in the core, between lyers of stretchers. Fig. 1 represents the plan of a three-brick wall, with the raking courses; and Fig. 2, the plan of

(FIG. 4.)

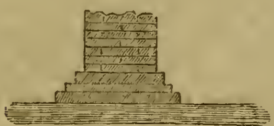


a wall of the same magnitude herring-boned. The courses are laid to an angle of 45 degrees, and are covered with an en-

tire course of headers, and in the next course the rake ought to be reversed, so that they cut each other at right angles. It can be seen by reference to the diagram, that the latter requires more filling in bats, thereby rendering it less secure than the other; but as raking courses ought never to be introduced into walls under two feet three inches thick, they will be very seldom required except in buildings of great magnitude.

I presume we now understand sufficient to commence laying the bricks, the great art of which is, to preserve an entire bond, and that each course of bricks be perfectly *horizontal*, both *longitudinally* and *transversely*, and also *plumb*; likewise, that each vertical joint recur perpendicularly over the other; this is technically called "keeping the perpends." Bearing the foregoing remarks in mind, we will commence the *footings*. The trenches being dug as before mentioned, and paved, if required, a course of bricks is laid; and at a set back, on every side of two and a quarter inches, another course is laid, and on this another at another set back of two inches and a quarter, and so on, until the desired number of footings is attained. The looser the ground, the more footings. The diagram shows the section of three

(FIG. 6.)



courses of footings there ought to be; and on the top course of footings, the walls are begun; but before they are carried up, it will be needful to make a few comments on the proper way of so doing. The bricklayer ought first to spread a layer of mortar on the last course of bricks, as far as he can conveniently reach, and on that the bricks, which ought to be rubbed down separately, so as to force all the glutinous matter out of the mortar into the pores of the bricks, and continuing so to do throughout the whole building. It is also very desirable that every brick should be damped just before it is to be worked in, as, if dry, it immediately absorbs the moisture of the mortar, and the pores of the brick being full of air, the adhesion will not be so perfect as if the bricks were wetted. Care ought likewise to be taken that no more mortar be used than will keep the bricks from touching each other, and the wet or air from forcing themselves into the heart of the wall. A great evil will likewise accrue to the wall if much mortar is used, and the bricks only laid, not *rubbed* down, as the weight of the brickwork above will force the mortar outwards, and which naturally forms itself *convex*, that catches every drop of rain that trickles down the walls, and which, in frosty weather in freezing bursts the mortar; and the only remedy is, that the whole face of the wall must be fronted. This, therefore, involves the necessity of rubbing each brick, and after forming the mortar as much *concave* with the trowel as possible. Eleven inches is the proper height for four courses of bricks. It often happens in practice, that the bricklayers omit putting any mortar between the edges of the bricks; and if the mortar is properly mixed, it is not sufficiently liquid to run into the joints. To fill up the spaces thus negligently left, is the cause of having walls *groated*. Groat is mortar made liquid, and being poured on the bricks, runs into the joints; but this, instead of benefiting, injures the wall, as the mortar, being so liquid, does not adhere; and if it forces its way into the heart of the wall, will force its way out again, and run down the wall, and, in the end, is like pouring water on the bricks; but supposing that it did adhere, it must occupy a longer time in drying, therefore makes and keeps the wall unstable. No part of a building ought to be carried up more than five feet at a time, as all walls shrink immediately after building. It was sometimes customary with the ancient Greeks to use neither mortar or cement in some parts of their building; the stones being perfectly smooth and rubbed together excluded the air, and therefore fixed themselves tighter together than with mortar.* The walls are, therefore, carried up until the height is attained at which the flooring joists are to be fixed. Intending to make carpentry a separate article, I shall defer treating on this for the present. They will, therefore, be carried up until it is necessary to erect the scaffold, which is performed by fixing a row of poles, termed *standards*, about fourteen or fifteen feet apart, or four or five from the wall; to these horizontally are attached other poles, called *ledgers*, the upper part of which ought to be about level with the top course of bricks; and one end of the *putlocks* are tied to the ledgers, and the other end rests on a stretcher in the wall, so that it leaves

* This experiment can be proved by rubbing together two pieces of smooth wood or stone, and in short time they will unite.

a space for a header to be inserted after the scaffolding is removed, and on these putlocks the scaffolding boards are placed. The weight which must necessarily be placed on the scaffolding, proves very injurious to the wall, as it presses down all the bricks which are perpendicularly under those on which the putlocks rest. To remedy this injury to the wall, is the cause of my placing before the readers of the "Mechanic," a description of my new scaffolding, which appeared in No. 5; and from what I have said, I leave the practitioner to judge which is most efficacious. Pieces of rough fir, about five inches by four, are placed round the building at various distances, and which are *dovetailed* together, to unite the different parts of the buildings, and to which the framing, skirting-boards, &c., are nailed. The fire-places are the next objects which require our attention; the chimney-breasts and jambs are made to stand out from the wall, but the distance is regulated by the thickness of the wall; the depth of a fire-place, generally speaking, ought not to be ess than fourteen inches; they are usually carried up from the bottom, but if not, recourse must be had to *corbelling*, which is performed by letting pieces of stone into the wall on each side of the fire-place, and on them the jambs are built up, until an opening is to be left for the flue. The general size of a common flue is fourteen inches by nine, but for a kitchen or very large fire-place, the flue ought to be fourteen inches square. When the height of the fire-place is attained, an arch ought to be turned to support the chimney breast; but as I intend making enlarged comments on the arches applicable for building, I shall defer this part until my next. It is sometimes necessary that the flues of different fire-places be carried up together, then the width between them and on every side ought to be four and a half inches. The chimney-breasts ought to be (in the cellar) one brick thick, and wall the other stories half a brick thick.

An opening for a window or door is next in rotation, and which is simply an omission of bricks until the proper height is attained. On each side of the opening the edges of the bricks ought to be *flush*. At four and a half inches from the face of the wall, a set back of four and a half inches is left to receive the window-frame, and which is technically termed the *reveal*. A set back is likewise left in an opening for a door of the same distance from the wall, and the same thickness, to take the door-posts, &c. In these openings wood bricks are sometimes substituted in lieu of common bricks, to which the window-frames or door posts are fixed.

ARCHITECTOR.

POPULAR KNOWLEDGE.

It was an old and much mistaken opinion of our forefathers, that study, or a love of reading, was a sure sign of indolence in a working man, and that, in fact, according to their notions, it tended to make him above his work, or, to be more explicit, it made him lazy, and was sure to fill his head with nonsense, and such kind of stuff as was quite unbecoming in a labourer.

But thanks to cheap publications and better internal communication, and numerous and well-organized charity schools, this mode of reasoning by hear-say, or from generation to generation in the same words, is now rapidly exploding; if it has not already disappeared, it will only be found in such poor and remote localities, which, from their position, do not admit so readily of communication with neighbouring places, where these improvements have reached. Since the establishment of these provincial and other charity schools more generally, the progress of the diffusion of elementary knowledge has been in most places as rapid and successful as could be expected; and the result is, that there has been an almost unprecedented demand of late years for cheap periodical publications to gratify the tastes of the humble classes, who now are capable of understanding their contents, and take a manifest pleasure in the perusal of them. In fact, the number of works of this kind that are now issued every week, bears unequivocal testimony that the schoolmaster has certainly been abroad, and inculcated with some success the tenets of the love of learning, or at least of popular reading, which is unquestionably the stepping-stone to higher things and more noble achievements, and will, in procees of time, if things continue to improve in the same order as they have done within the last few years, produce abundance of good sound sense and substantial learning, as a general characteristic trait amongst the very humblest of the lower classes. When I speak of sound learning, I neither mean Latin, Greek, or any such accomplishments; but sound and useful information, such as a working man requires, and such as he can apply to his immediate wants; and it is my firm conviction, that every man, with few exceptions, is born with sufficient intelligence, but which lies hid and buried, as it were, in a latent state

for want of successful cultivation, and a little careful pruning and nursing in *early youth*, which is the most proper time for laying the foundation of a fabric, the utility of which all men must acknowledge, and the want of which, in many parts of this country, we have unfortunately too much reason to deplore.

John Locke, the matchless author of the "Proper Conduct of the Understanding," speaking of the improvement of the mind, and more particularly alluding to the effects of practice and habit, says, "We are born with faculties and powers capable almost of anything, such as at least would carry us much further than can be easily imagined; but it is only the exercise of these powers which gives us ability and skill in anything, and leads us towards perfection." This being the case, we see at once the importance of every person who wishes for self-improvement, being careful and attentive to that particular part which he wishes to learn, of any art or science, but more generally, it appears, by rigidly practising the mind, we may, if we choose, by exertion, bring it to follow any particular branch of study that we wish, or which our positions and circumstances require in the affairs of life.

Now these elementary and apparently trifling remarks are of the very utmost importance, and are deserving of a much longer discussion than the limits of this paper will allow, because from these it would appear, that the intellect is capable of undergoing, as it were, two grand changes immediately after emerging from infancy. Thus, in the first case, by gross neglect and bad example, the purity of mind may be blighted in its first budding, and, if this is the case, as practice fixes the habit, so will it be almost impossible to eradicate it, if it is suffered to pursue its own vicious course for any length of time, and, on the contrary, it may pursue another course, directly the reverse of the former, by following good examples and pursuing them to the end, and in both cases, let what will be the system, right or wrong, the constant pursuit of that course will induce habit, and by this means it will become fixed for ever.

Here, then, we have a brief example of the necessity of *early* and careful education; and it is well known that a few years of early tuition is far more advantageous than many at a later period, at least as far as fixing any particular course goes; but we must not deny, that the mind can be improved, and greatly improved, at a later period, though not with so much ease; besides, very few men of the class to which I shall principally allude, have the necessary time to spare for such a desirable purpose, even if they were quite willing, for the multiplied affairs of life will be too constant in their calls for attention, for them to give much time to such an object, however agreeable and interesting self-improvement might be to them. It is, therefore, important that schools easy of access to the poor should be established in every town and village of the country, and not only schools established, but I think laws enacted so as to compel parents to send their children to these schools between a certain fixed age, say from 4 to 10 at least, and those parents who do not send their children to school when they have an opportunity of so doing, are deserving of a very severe punishment, because they are evidently withholding from their offspring a boon, the value of which cannot be too highly estimated, besides in a great measure throwing them directly in the way, the most likely to be productive of all kinds of immorality which it is the duty of all men to prevent, if possible; and it must be admitted, that if any means are capable of doing this, it will be early education, and the early inculcation of morality, and evidently it will be of the most important use and good to the children themselves in after life. And if once the mind of a child has been subjected to a judicious course of study and training, the principles will remain and become fixed, so that in life, amidst all its turmoil and bustle, he will find the same principles apply even to some of its most intricate affairs, and besides the manifest pleasure and advantage which education must yield, he will find that practice will give him greater quickness and capability, and a sounder and more extensive judgment.

A husbandman would look in vain, ad for ever upon his fields and vineyards for plentiful crops, if he did not at a proper time put his strength to the wheel and prepare and cultivate his ground; when he has done this, then, at the proper season, may he "garner together" the fruits of his labour and industry, and in proportion to the care with which he watches and nurses his lands, so will he be repaid a "hundred fold" or more; but his land neglected, all becomes withered, blasted, and barren, and his indolent hopes of success vanish, and he is left poor, helpless, and with empty granaries. And as it is with the farmer, so it is with the mind; if trained from youth to a constant course of judicious exercise, and carefully cultivated and pruned from the weaknesses which appears inherent in the human mind, we

may hope for the development of talent and a noble energy of mind, which could never have been brought into life and action without care and study. Practice is unquestionably the grand secret by which most minds are brought to their greatest pitch of strength and brightness, and nought but exertion can ever produce the results to which we know some minds arrive, through a constant course of perseverance. In early youth, the mind and understanding is as soft, pliant, and flexible as the limbs, and, like the passions, can by care be moulded to any form, and when once this system of training is properly begun and established, there will not be found any difficulty in maintaining it; and from the continuance of such a course, the noblest results may be confidently anticipated.

We are aware, from experience, of the surprising produce of unceasing industry, and so shall we find it with the intellect, if we come to examine into the lives and actions of those men who have been celebrated for their great mental powers; we shall find that all their greatness is the result of constant mental exertion and unwearied labour. I shall endeavour to illustrate this point in the next.

EBORACUM.

(*To be continued.*)

COMPRESSIBILITY OF LIQUIDS.

To the Editor of the Mechanic and Chemist.

LIQUIDS are compressible by mechanical force in so slight a degree, that they are considered in all hydrostatical treatises as incompressible fluids. They are not, however, absolutely incompressible, but yield slightly to very intense pressure. The question of the compressibility of liquids was raised at a remote period in the history of science. Nearly two centuries ago, an experiment was instituted at the Academy del Cimento, in Florence, to ascertain whether water be compressible. A hollow ball of gold was filled with the liquid, and the aperture exactly and firmly closed. The globe was then submitted to a very severe pressure, by which its figure was slightly changed. Now it is proved, that a globe has this peculiar property, that any change whatever in its figure must necessarily diminish its volume or contents. Hence it was inferred, that if the water did not issue through the pores of the gold, or burst the globe, its compressibility would be established. The result of the experiment was, that the water *did* ooze through the pores, and covered the surface of the globe, presenting the appearance of dew. But this experiment was inconclusive. It is quite true, that if the water *had not* escaped upon the change of figure of the globe, the compressibility of the liquid would have been established. The escape of the water does not, however, prove its incompressibility. To accomplish this, it would be necessary first to measure accurately the volume of water which transuded by compression, and next, to measure the diminution of volome which the vessel suffered by its change of figure. If this diminution were greater than the volume of water which escaped, it would follow, that the water remaining in the globe had been compressed, notwithstanding the escape of the remainder. But this could never be accomplished with the delicacy and exactitude necessary in such an experiment, and, consequently, as far as the question of the compressibility of water was concerned, nothing was proved. It forms a very striking illustration, however, of the porosity of so dense a substance as gold, and proves that its pores are larger than the elementary particles of water, since they are capable of passing through them. It has since been proved, that liquids are compressible. In the year 1761, Canton communicated to the Royal Society the results of some experiments which proved this fact. He provided a glass tube with a bulb, and filled the bulb and a part of the tube with the liquid well purified from air. He then placed this in a condenser, by which he was enabled to submit the surface of the liquid in the tube to very intense pressure of condensed air. He found, that the level of the liquid in the tube fell in a very perceptible degree upon the application of the pressure. The same experiment proved that liquids are *elastic;* for upon removing the pressure the liquid rose to the original level, and, therefore, resumed its former dimension.—I am, Sir, yours, &c.,

A. D. M.

Immense Sheet of Paper.—There was sent from the paper-manufactory at Colinton, last week, a single sheet of paper weighing 553 lbs., and upwards of a mile and a half in length; the breadth only 50 inches. Were a ream of paper composed of similar sheets made, it would weigh 266,500lbs., or upwards of 123 tons.—*Scotsman.*

STEAM CARRIAGES ON COMMON ROADS.

To the Editor of the Mechanic and Chemist.

Sir,—Although no advocate for monopoly, still, I think Mr. T. S. Browne, when he says the London and Birmingham Railway has ransacked 89 coaches of their passengers, should remember, that they (the passengers) are conveyed on the railway, and not prevented from visiting Birmingham and other towns; and that it appears from the Stamp Office returns, that, even when the Birmingham Railway was so incomplete, as to occasion the great inconvenience to the passengers, of twice changing their conveyance in the course of a journey, there was an increased communication, to the extent of 50 per cent., in addition to the great number of persons, who unwilling to encounter the inconvenience, continued to avail themselves of the old modes of conveyance. Though we have not, at present, received the great benefit as was at first held out: viz. by a cheaper and quicker transit of goods, things would be cheaper, and we should be enabled to compete with the foreign markets.

The Birmingham Railway increases facilities of intercourse between the metroplis and the chief manufacturing districts in England, as well as with Scotland and Ireland; bringing Liverpool and Manchester within a day's journey: passing near large towns, and giving new life to intercourse, already animated and extensive. No time has been lost by the Post Office authorities, in turning to advantageous account the facilities afforded by the railway; in consequence of which, we have two deliveries instead of one. I find in 1837, on the Grand Junction Railway, that there were about 740 mail bags, taken up and set down, every day, at the several stations on the line. A stimulus to business which cannot fail of being beneficially felt. And as for "the working classes suffering from want and starvation, merely because the London and Birmingham Railway Company chose to monopolize all the traffic of the manufacturing districts;" that is in favour of the railway, inasmuch as it shows its utility; for if the manufacturers could convey their goods in a better way, they undoubtedly would. And as for "suffering from want", it will cause a greater number of hands to be employed in the manufacturing districts; for so great has been the demand for hands, that individuals and whole families have emigrated from other districts: and an incongruous population has been furnished by the poorest districts of Ireland. In Lancashire alone, there are about 200,000 Irish and their immediate descendants. The railway itself has employed and still does employ, a multitude in the shape of policemen; 1 to each mile. Thus, if they serve 8 hours in the 24, they employ 360. The clerks are very numerous; in some cases, 4 to each station. The porters are from 6 to 10 at each station: and upwards of 20 at Euston Square; and about the same at Birmingham. The guards, engineers, and stokers, on the different trains, and the labourers on the line of road to keep it in repair; mechanics and others at their extensive works at London and Birmingham; the coachmen and conductors to the omnibuses conveying the passengers to and from the different stations. Thus, I think the railway cannot be the cause of the working classes of this country starving.

I am, Sir, your's respectfully,
Bishopsgate. C. H. S.

LONGEVITY.

To the Editor of the Mechanic and Chemist.

Sir,—I beg to state, in the outset, that the following is a compilation; a considerable portion being extracted from an article in Partington's Cyclopedia, which is itself a collection from various sources. This explanation is necessary, as it might otherwise be thought, that on the one hand I had misrepresented an author by intercalating my own observations, or, on the other hand, that I had appropriated that which did not belong to me.

There is an epitaph on an old tombstone, I believe it is in Scarborough Churchyard, which, though expressed in the gross language which characterizes necrological poetry, may be made a text for very serious meditation:—

> "This world's a city, full of crooked streets;
> Death is the market-place, where all men *meets.*
> If life were merchandize, which men could buy,
> Rich men would live, the poor must die."

It might be a matter of entertainment to relate extraordinary instances of longevity, and a useful lesson to point out some of the millions of examples of premature death, snatching exulting youth from the arms of affection, and the hot-bed of opulence and honours; but although it is not given to human nature to ensure a long life, still there are many circumstances which are known to abridge that inestimable and incomprehensible gift. My chief object is to point out those circumstances,

in order that a remedy, or at least an amelioration, may be obtained. I shall not dwell upon the folly of those who voluntarily shorten their existence by various excesses, but proceed to show the influence which different occupations have upon the health, and consequently the length of life, amongst the working classes.

Out-door Occupations. — Butchers are subject to few ailments, and these are the result of plethora. Though more free from disease than other trades, they, however, do not enjoy greater longevity; on the contrary, Mr. Thackray, of Leeds, thinks their lives shorter than those of other men who spend much time in the open air. Cattle and horse-dealers are generally healthy, except when their habits are intemperate. Fishmongers, though much exposed to the weather, are hardy, temperate, and long-lived; cart-drivers, if sufficiently fed, and temperate, the same. Labourers in husbandry, &c., suffer from a deficiency of nourishment. Brickmakers, with full muscular exercise in the open air, though exposed to vicissitudes of cold and wet, avoid rheumatism and inflammatory diseases, and attain good old age. Paviors are subject to pains in the loins increasing with age, but they live long. Chaise-drivers, postillions, coachmen, guards, &c., from the position of the two former on the saddle, irregular living, &c., and from the want of muscular exercise in the two latter, are subject to gastric disorders, and finally, to apoplexy and palsy, which shorten their lives. Smiths are often intemperate, and die comparatively young. Carpenters, coopers, wheelwrights, &c., are healthy, and long-lived. Ropemakers and gardeners suffer from their stooping postures.

In-door Occupations.—Tailors, notwithstanding their confined atmosphere, and bad posture, are not liable to acute diseases, but give way to stomach diseases, and consumption. The prejudicial influence of their employment is rather insidious than urgent; it undermines, rather than destroys, life. Staymakers have their health impaired, but live to a good age. Milliners, dressmakers, and straw bonnetmakers, are unhealthy, and short-lived. Spinners, cloth-dressers, weavers, &c., are more or less healthy, according as they have more or less exercise and air. Those exposed to inhale imperceptible particles of dressings, &c., such as frizers, suffer from disease, and are soonest cut off. Shoemakers are placed in a bad posture; digestion and circulation are so much impaired, that the countenance marks a shoemaker almost as well as a tailor; the secretion of bile is generally unhealthy, and bowel complaints are frequent. In the few shoemakers who live to old age, there is often a remarkable hollow at the base of the breast-bone, occasioned by the pressure of the last. Curriers and leather-dressers are very healthy, and live to old age. Saddlers lean much forward, and suffer accordingly from headache and indigestion. Printers (the lamplighters of intellect, who fix a thought as Daguerre does a shadow) are kept in a confined atmosphere, and generally want exercise. The constant application of the eyes to minute objects gradually enfeebles those organs; the standing posture, long maintained here, as well as in other occupations, tends to injure the digestive organs. Pressmen, however, have good and varied labour. Bookbinders, a healthy employment. Carvers and gilders look pale and weakly, but their lives are not abbreviated in a marked degree. Clockmakers are generally healthy, and long-lived; watchmakers, the reverse. House servants, in large, smoky towns, are unhealthy. Colliers and well-sinkers—a class by themselves—seldom reach the age of 50.

Employments producing Dust, Odour, or Gaseous Exhalations.—These are not injurious if they arise from animal substances, or from the vapour of wines or spirits. All insoluble matter, habitually inhaled, is injurious, although it may be inert in its nature, and produce no immediate effect. Tobacco-manufacturers do not appear to suffer from the floating poison in their atmosphere. Snuffmaking is more pernicious. Men in oil-mills are generally healthy. Brushmakers live to a great age. Grooms and ostlers inspire ammoniacal gas, and are robust, healthy, and long-lived. Glue and size-boilers, exposed to the most noxious stench, are fresh-looking, and robust. Tallow-chandlers, also exposed to offensive animal odour, attain considerable age. Tanners are remarkably strong, and exempt from consumption. Corn-millers, breathing in an atmosphere loaded with flour, are pale and sickly, and very rarely attain old age. Maltsters do not live long, and must leave the trade in middle life. Teamen suffer from the dust, especially of green teas; but this injury is not permanent. Coffee-roasters become asthmatic, and subject to headache and indigestion. Paper-makers, when aged, cannot endure the effect of the dust from cutting the rags. Masons are short-lived, dying generally before 40; they inhale particles of sand and dust, lift heavy weights, and are too often intemperate. Miners die prematurely. Machine-makers

seem to suffer only from the dust they inhale, and the consequent bronchial irritation. The iron-filers are almost all unhealthy men, and remarkably short-lived. The occupation of a grinder is, perhaps, the most injurious of any that is practiced; I lately spoke upon the subject to a considerable manufacturer of Sheffield, who assured me that he did not know one grinder in Sheffield, having constantly followed that occupation, who had attained the age of 50. Many plans have been devised to attenuate the evil; one very good one was published in this work, but the workmen will not trouble themselves so far as even to give them a trial. Water-gilding is very pernicious, but may be rendered much less so by care and cleanliness. Brassfounders suffer much from the inhalation of the volatilized metal; in the founding of yellow brass, in particular, the evolution of oxide of zinc is very great. They seldom reach 40 years. Coppersmiths are considerably affected by the fine scales which rise from the imperfectly volatilized metal, and by the fumes of the spelter, or solder of brass. The men are generally unhealthy, suffering from disorders similar to those of the brass-founders. Tin plate-workers are subject to fumes from muriate of ammonia, and sulphurous exhalations from the coke which they burn; these exhalations, however, appear to be annoying rather than injurious, as the men are tolerably healthy, and live to a considerable age. Tinners, also, are subject only to temporary inconvenience from the fumes of the soldering. Plumbers are exposed to the volatilized oxide of lead, which rises during the process of casting; they are sickly in appearance, and short-lived. House-painters are unhealthy, and do not generally attain full age. Chemists and druggists, in laboratories, are sickly and consumptive. Potters, affected through the pores of the skin, become paralytic, and are remarkably subject to consumption. Hatters, grocers, bakers, and chimney-sweepers, also suffer through the skin; but although the irritation causes diseases, they are not, except in the last class, fatal. Dyers are healthy, and long-lived. Brewers are, as a body, far from healthy; under a robust, and often florid appearance, they conceal chronic diseases of the abdomen, particularly a congested state of the venous system. When these men are accidentally hurt or wounded, they are more liable than others to severe and dangerous effects. Cooks and confectioners are subjected to considerable heat; our common cooks are more unhealthy than housemaids. Their digestive organs are frequently disordered; they are subject to headache, and their tempers rendered irritable. Glass-workers are healthy. Glass-blowers often die suddenly. Literary occupations do not appear to be more injurious than many others. Many of the first *literati*, most distinguished for application throughout life, have attained old age, both in ancient and modern times.

There is a remarkable difference in the relative mortality in different places; and it is equally worthy of remark, that in most places the mortality is considerably less than it was a century ago.

In Geneva, records of mortality have been kept since 1590, which show that a child born there has, at present, five times greater expectation of life than one born three centuries ago. A like improvement has taken place in the salubrity of large towns. The annual mortality of London, in 1700, was one in twenty-five; in 1751, one in twenty-one; in 1801, and the four years preceding, one in thirty-five; in 1811, one in thirty-eight; and in 1821, one in forty, which is about the average at the present time; the value of life having thus doubled in London within eighty years. In Paris, about the middle of the last century, the mortality was about one in twenty-five; at present, it is about one in thirty-two; and it has been calculated that, in the fourteenth century, it was one in sixteen or seventeen. The annual mortality in Berlin has decreased, during the last fifty or sixty years, from one in twenty-eight to one in thirty-four. The mortality in Manchester was, about the middle of the last century, one in twenty-five; in 1770, one in twenty-eight; forty years afterwards, in 1811, the annual deaths were diminished to one in forty-four; and in 1821, they seem to have been still fewer. In the middle of the last century, the mortality in Vienna was one in twenty; it has not, however, improved in the same proportion as some of the other European cities. According to recent calculation, it is, even now, one in twenty-two and a half, or about twice the proportion of Philadelphia, Manchester, or Glasgow. The following is the annual mortality of some of the chief cities of Europe and America:—

Philadelphia	1 in 45.68
Glasgow	1 in 44
Manchester............	1 in 44
Geneva	1 in 43
Boston................	1 in 41.26
London	1 in 40
New York	1 37.83
St. Petersburgh........	1 in 37

Charleston	1 in 36.50
Baltimore	1 in 35.44
Leghorn	1 in 35
Berlin	1 in 34
Paris, Lyons, Barcelona, and Strasburgh	1 in 32
Nice and Palermo	1 in 31
Madrid	1 in 29
Naples	1 in 28
Brussels	1 in 26
Rome	1 in 25
Amsterdam	1 in 24
Vienna	1 in 22.5

The following is the number of deaths in the city of London, and bills of mortality, from December 15, 1830, to December 13, 1831 :—

Under two years of age	7,812
Between two and five	2,647
Five and ten	1,031
Ten and twenty	934
Twenty and thirty	1,649
Thirty and forty	1,968
Forty and fifty	2,175
Fifty and sixty	2,269
Sixty and seventy	2,237
Seventy and eighty	1,786
Eighty and ninety	825
Ninety and 100	101
One hundred	1
One hundred and one	1
One hundred and five	1

The following are a few instances of extraordinary longevity :—Our own countryman, Parr, who was born in 1483, married when at the age of 120, retained his vigour till 140, and died at the age of 152, from plethora; Harvey, the distinguished discoverer of the circulation of the blood, who dissected him, found no decay of any organ.—(*Philosophical Transactions*, vol. iii. 1698.) Henry Jenkins, who died in Yorkshire, in 1670, is, perhaps, the greatest authentic instance of longevity; he lived 169 years. Margaret Forster, a native of Cumberland, died in 1771, aged 136; and James Lawrence, a Scotchman, lived 140 years. A Dane, named Drakenberg, died in 1772, in his 147th year; and John Effingham, or Essingham, died in Cornwall, in 1757, aged 144. In 1792, a soldier, named Mittlestedt, died in Prussia, at the age of 112. Joseph Surrington, a Norwegian, died at Bergen, in 1797, aged 160 years. The St. Petersburgh papers announced, in 1830, the death of a man, 150 years old, at Moscow; and in 1831, the death of a man in Russia, 165 years old, was reported.

The qualification required of a candidate for old age is abstinence from these four things :—physic, teetotalism, intemperance, and dishonour. Q. E. D.

REVIEW.

Hints to Mechanics on Self-education and Mutual Instruction. By Timothy Claxton. London: Taylor and Walton.

Under this modest title will be found some of the most useful precepts and admonitions ever addressed to the working classes. The style is unaffected, but cogent, and sometimes approaches to enthusiasm, so deeply does the author appear to be penetrated with the truth and importance of his work.

The author states that he is himself a mechanic, and the sketch he gives of his own life, is an excellent illustration of the soundness and practical advantages of the principles he inculcates.

Mechanics wishing to form themselves into societies for mutual instruction, will find in this volume, not only useful "hints," but a sure and valuable guide. We strongly recommend a perusal of this book to all mechanics, being confident that much useful knowledge and material benefit will be derived from it. In a future number we will present some extracts to our readers.

Pestalozzian Maxims, on the requisite Conditions to be presented by the Mother in the Education of her Child. By Francis Wilby. Published at the Pestvlozzian Academy, Worship-street, Finsbury.

The pervading sentiment in these maxims, is the advantage of early training of the infant mind in a virtuous course, not by coertion, but by the power of affection; and such things only are to be proposed, as the embryo intellect can comprehend. The principles are sound and moral; but the obscurity of the language is such, that few, if any mothers, will understand them. The 35th maxim is expressed as follows:—"The vital education of thy child cannot be effected by the externalities of form, but by thy sympathizing aid in the evolving of its informing creations." It is to be feared that few mothers will be found capable of following the author in the immense strides he has taken from "heigh diddle diddle, the cat and the fiddle," to such tasks as this.

The Little Mineralogist, or First Book of Mineralogy. By the Rev. T. Wilson. Darton and Clark.

A very elegant and excellent little book. The epithet "little" must apply rather to the volume than to the reader; for

though the style is simple enough to edify a child, the information it contains will amply repay any one who does not wish to dive deeply into the science, for the trouble of perusing it. It is illustrated with beautiful coloured plates, and contains much more accurate information than will be found in most volumes of the same dimensions.

Sacred Harmony, a Selection of Psalm and Hymn Tunes, arranged for Three Voices (two Trebles and a Bass). D. Murray, Chelsea, &c.

We have received two monthly parts, each containing eight tunes. The music is prettily arranged, but the words are omitted, and figures substituted for the syllables under the proper notes; this appears to us to be a defect; if it is not thought right to practise with the words, they might be inserted in a separate page.

STEAM LOCOMOTION.

To the Editor of the Mechanic and Chemist.

Sir,—The following calculations of the relative expense of steam, and common stage conveyance, on common roads, is not founded upon any uncertain theory, but deduced from actual working with steam and stage-coaches.

The expenses of a stage-coach, for 100 miles of road, up and down daily, are as follows:—

	£.	s.	d.
Horsing, at 2*s.* 7½*d.* per double mile	10	12	6
Mileage paid to the contractor for the use of his coach, at 3*d.* per mile	2	10	0
Passenger duty, at 1*d.* per mile for every four passengers, average 10 each way	2	1	8
Horse and carriage duty, turnpikes, duty on coachmen and guards, wages of attendants, rent of booking-offices, sundries, &c.	10	0	0
	£25	4	2

REVENUE OF A STAGE-COACH ON 100 MILES OF ROAD DAILY.

	£.	s.	d.
Eight outside passengers, at 1*l.* each, for each way	16	0	0
Two inside passengers, at 1*l.* 10*s.* each, up and down	6	0	0
Short passengers, of 20 miles or so	3	10	0
Parcels, &c., &c.	8	0	0
Revenue for 100 miles work	33	10	0
Expenses of ditto	25	4	2
Daily balance of profit	£8	5	10

The expenses of a "steamer" for such a journey are thus stated by Mr. Hancock, in his valuable work on locomotion; and as he is the man who, for many years, has been engaged in the good work of wresting from 2,000,000 horses a territory that, if properly cultivated, would provide food for more than double that number of our now starving mechanics, I should think that the utmost reliance ought to be placed on his calculations, and will, therefore, give them verbatim.

EXPENDITURE.

	£.	s.	d.
Coke, 1*s.* per double mile	5	0	0
Repairs, wear and tear	4	0	0
Oil, hemp, &c.	0	10	0
Two engineers, two steersmen, two stokers, and guards	2	0	0
Wages of attendants, rent of stations, &c.	3	0	0
Tolls	1	10	0
Fund for carriages	4	0	0
Contingencies	2	0	0
Daily expenses	£22	0	0

REVENUE.

	£.	s.	d.
Fifty passengers, at 1½*d.* per mile each	31	5	0
One ton of luggage, at 1*d.* per cwt. per mile	9	6	8
Total	40	11	8
Deduct 20 per cent. for light loads	8	2	4
Daily revenue	32	9	4
Deduct daily expenses	22	0	0
Leaving a daily profit of	£10	9	4

From this it will be seen, that Mr. Hancock has proved that 50 passengers can be conveyed on turnpike-roads, any distance, by steam, for one-eighth of what it would cost to forward a dozen passengers by a stage-coach. The query, then, is, Why is it not brought into more extensive practice? This I will answer in my next.

St. Alban's. T. S. Browne.

LONDON AND BRIGHTON RAILWAY.

The locomotive engine, which has been named "The *Brighton*," lately sent down by the railway company to facilitate the works on the Shoreham branch, was on Tuesday tried on a portion of the line, about a mile and a half in extent, on which

the permanent rails have already been laid. Preparations having been made by Mr. Statham, the resident engineer, to start at twelve o'clock, R. Heaviside and T. Robinson, Esqrs. (two of the directors) accompanied by the Earl of Munster, the Hon. F. Greville, Capt. Ellis, M.P., and others, took their seats in two of the waggons used for removing the earth, and which had been fitted up for the purpose. The shortness of the distance precluded, of course, an attempt at speed, but the result of the trial of the road was most satisfactory; and the novelty of the sight in this part of the country drew together a large concourse of spectators. We are happy to state that the works on the Shoreham branch are progressing with great activity. The tunnel under Lashmar's mill is proceeding night and day; and the land purchased of Mr. Kemp has been enclosed from the mill to the terminus, crossing the Montpellier road. As great a number of excavators as the space will admit are engaged on the cutting at Fuller's hill, in the parish of Aldrington: and as soon as this is completed, which it is anticipated will be the case in a month, permanent rails will be laid for the distance of about four miles, and the engine will be used for the purpose of removing the earth from the cuttings and tunnels at the Brighton end of the branch. The works on the London part of the line are also proceeding with great rapidity.—*Brighton Gazette.*

Railway Travelling in America.— Nothing can be conceived more comfortable in the coldest weather than travelling on the system adopted on the Baltimore railroad. It has all the ease and power of locomotion which a person finds on the steamer, with nearly double the rapidity of progress. In the night line, I am told, they have beds for the passengers; and in another year I should not be surprised to see dinners, or at least refreshments, or *dejeuners*, given in these cars at the very moment the traveller is going 30 miles per hour. The same system prevails on the road to Washington. If the new line from Philadelphia to Jersey city can be organised on this plan, the winter travelling from New York to Washington will be in advance of that of the whole world for ease, comfort, dispatch, and convenience. A fine lady can embark in the morning at Jersey city, and reach washington at night in time for a *soiree*, without deranging her curls, or feeling or knowing whether the thermometer is under or over zero.—*New York Herald.*

New Lamp for Lighthouses.—Professor Faraday, on the 15th instant, gave an interesting lecture, at the Royal Institution, on the subject of a new lamp, invented, or rather brought to perfection (for the invention is not, it appears, altogether new), by Mr. Gurney, which Mr. Faraday proposed to call the "oxy-oil lamp," for want of a name better describing its nature, not having, as he stated, been at present informed what name the inventor intended to give it. The new lamp most nearly resembles the common argand lamp, with this difference—that its burners may be made to equal, at the lowest, two and a half, and at the highest number, 50, of the common burners; and into the flame of which a stream of oxygen gas is introduced, by which operation the character of the flame is changed from a dark, smoky light, to the bright, and indeed brilliant light of the hydro-oxygen lights now used for microscopic exhibitions. The application of oxygen gas to the light of common oil lamps is not new, Dr. Priestley having discovered the use of such application many years ago; but to Mr. Gurney belongs the merit of having overcome all the difficulties which stood in the way of its practical application, and everyday use. The lamp in question is more immediately intended for lighthouse purposes, and Mr. Gurney, it seems, has been engaged for three years in the most persevering and undaunted experiments in completing his task, which is the more laudable, inasmuch as, on the authority of Mr. Faraday, for five-sixths of that time all his efforts appeared fruitless in overcoming the objections to, and surmounting the obstacles which stood in the way of, the completion of this useful invention. The introduction of the oxygen has the effect of decreasing the length of the flame, which is thus better adapted for the marine purpose to which it is destined; and it has the greatest of all recommendations, namely, economy, in its favour. This is not, however, apparent at first view, for the gas costs double the amount of the oil. But the introduction of the former effects such a diminution in the consumption of the latter, that not only is the expense of the gas and the apparatus used in its preparation paid for, but an ultimate saving, as well as a most superior light, is the result. This lamp was the text of the professor's discourse for the evening, and he treated it in so lucid and pleasing a manner, as to render his lecture exceedingly interesting, and to elicit the applause of a numerous and scientific audience. —*Times.*

THE CHEMIST.

PHLORIZINE.

EXPERIMENTS AND RESEARCHES OF M. STAS.

PHLORIZINE is a substance recently discovered in the bark of the root of the apple tree. It is a white substance crystalized in needles, of a sweet taste, soluble in water, and in alcohol, precipitating the sub-acitate of lead, and resembling by its general properties both salicine and orcine.

Under the simultaneous influence of water, air and ammonia, phlorizine undegoes a remarkable transformation; it absorbs rapidly and in great quantities the oxygen of the air, and from white it changes to a magnificent blue. This new body is an ammoniacal salt, produced by a red colouring matter, incrystallizable, and like indigo, it loses its colour under the influence of disoxidizing causes, and, like indigo, recovers its colour by the contact of oxigen.

The transformation of white phlorizine into coloured, is operated with great facility; it is sufficient to expose phlorizine moistened with a little water, in air charged with ammoniacal gas. After a short time of action, the phlorizine is observed to assume a darker colour; from canary yellow, it becomes orange, then red, then purple, and, at last, at the end of three or four days, the whole presents a thick mass of a beautiful blue colour.

This mass, dissolved in a small quantity of water, is poured into alcohol, in which the blue matter is insoluble. By this process the phlorizine is separated; the precipitate, which is an ammoniacal salt of phlorizine, dissolved again in a small quantity of water, is composed by acetic acid, which precipitates a blood-red substance, which is pure *phlorizine*.

When we consider (observes M. Stas) the facility with which this substance is obtained, and, on the other hand, the increasing difficulty of procuring lichens for the manufacture of orseille, it is worthy of consideration, whether phlorizine, which it will be seen has a great analogy to orceine, might not be substituted for that matter in the arts.

Many transformations of a similar nature are known, and attributed to the same circle of action, and it is not proved that indigo is not produced from the same source.

Under the influence of acids, phlorizine is separated into two distinct bodies, one of which is the sugar of raisins, and the other a new body, *phloretine*, which is a white matter, crystallized in small leaves, of a sweet taste, soluble in alcohol, acetic acid, and the alkalies, but less soluble in water. If an aqueous solution of phlorizine, acidulated by oxalic acid, or any mineral acid which does not easily part with its oxygen, be exposed to heat, the limpid solution will lose its transparence at about 80° or 93°, and a crystalline substance will be deposited, which is phloretine. The acid liquor which remains neutralized by a base which is insoluble in the acid employed, leaves after evaporation, a white substance difficultly crystallizable, sweet, fermentible, and in every respect identically the same as sugar of raisins. The decomposition of phlorizine into sugar of raisins and phloretine, is remarkable, as it must modify the idea hitherto entertained of the production of the sugar of fruits; and it may be conjectured, that the sugar of fruits is formed by the action of decomposing acids, which are always found in fruits, upon substances which have not hitherto been isolated, or examined in that direction.

The study of the action of acids and of bases upon neutral organic substances, strengthens this opinion, and tends even to prove, that this kind of action is pretty general. M. Piria has obtained sugar of raisins from a resinoid substance, by the action of acids upon salicine; so that the conjectures of to-day will probably be converted into certain and valuable facts, by future experiments and investigations.

TO PRESERVE PASTE FROM MILDEW.

To the Editor of the Mechanic and Chemist.

SIR,—Observing an article in No. 107, from "T. T." to prevent ink-mould, I have sent you the following on the use of perfumes in preserving that perishable article paste from mouldiness or decay, thinking it might not be unacceptable. Your mineralogical readers in particular, who have frequent occasion to use paste for their labels in very small quantities, and where the trouble of thus making it on every fresh occasion is inconvenient, will be glad to know that this useful article may be made to keep even for years, always ready for use, and subject to no change. The paste is made of flour in the usual way, but rather thick, with a proportion of brown sugar, and a small quantity of corrosive sublimate. The use of the sugar is to keep it flexible, so as to prevent its pealing off from smooth surfaces, and that of the corrosive sub-

limate, independently of preserving it from insects, is an effectual check against its fermentation. This salt, however, does not prevent the formation of mouldiness, but as a drop or two of the essential oils, such as lavender, peppermint, cloves, anice, and bergamot, is a complete security against this, all the causes of destruction are effectually guarded against. Paste made in this manner and exposed to the air, dries without change to a state resembling horn, so that it may at any time be wetted again and applied to use. When kept in a close covered pot, it may be preserved in a state fit for use at all times.

OXYGEN GAS.

There are many processes by which this gas may be obtained, from which the experimenter may make his selection according to his convenience. If a large quantity of the gas is required, by far the best method is, to put about half a pound of the black oxide of manganese (which may be procured at Allen's, of Plough-court, Lombard-street, at a very low price) into an iron bottle, to the neck of which a metal flexible tube is adapted. The bottle is then to be subjected to the heat of a common fire. When the bottle has acquired a dull red heat, the gas comes over in abundance, and is to be collected over water in the usual manner. Iron bottles for this purpose may be procured at Knight's, Foster-lane, Cheapside; they are, however, rather expensive, and should this be an objection, a gun-barrel (the touch-hole being securely stopped) will answer the purpose very well, two or three feet of tube being adapted to its mouth. Another method is, to put into a retort two parts of the black oxide of manganese, and one part of sulphuric acid; on applying a moderate heat (that of a spirit lamp), the gas is evolved, and may be collected as usual. 3rdly. When nitrate of potassa (saltpetre) is subjected to heat, it melts and afterwards boils, giving off oxygen gas. 4thly. Chlorate of potassa, treated in the same way, yields oxygen gas in its greatest purity; but this is an expensive process; 5thly. Red lead, moistened with sulphuric acid, and subjected to heat, also evolves this gas. In the performance of any of these processes, in order to ascertain whether the gas is coming over, a piece of stick, previously lighted and blown out, so as to leave a redness, should be occasionally applied to the mouth of the tube or retort; if gas be coming over, the stick will be instantly relighted. It should be observed, that, in the second process, immediately after the gas ceases to be evolved, the retort should be filled with hot water, otherwise the contents of the retort, by being suffered to cool, form a hard cake of sulphate of manganese in the bottom, which will defy all means which may be tried for its extraction, it being perfectly insoluble; the consequence is, of course, the loss of the retort.

J. B——u.

CHLORATE OF POTASS.

The best method with which I am acquainted for procuring chlorate of potassa, is by saturating a solution of caustic potass (potassa fusa of the shops) with chlorine gas in a series of Woulfe's bottles, the first of the series being empty to retain any impurities. There is another method, by dissolving in boiling water a large quantity of pearl ashes, and allowing it to stand until it becomes cold; this solution is afterwards agitated with chlorine gas. The product in both cases is to be evaporated and allowed to crystallize; the crystals are the chlorate of potass. Should any further explanation be required, I shall be most happy to give it. I have omitted any description of the process, supposing it to be understood already. Care should be taken not to allow much of the chlorine gas to escape into the apartment, as it is extremely injurious to the breathing apparatus.

J. B——.

CURSORY REMARKS ON TOXICOLOGY.

NO. IV.

England is happily infested with few venemous reptiles,—the viper is the principal one, and salad or olive oil, applied liberally to the wound, is the chief remedy for its bite. Buffon says, "If a viper inflicts a wound, and the remedy be neglected, the symptoms are not without danger. It first causes an acute pain in the place affected, attended with a swelling, first red and afterwards livid. To this succeeds great sickness and convulsive vomiting, cold sweats, pain about the bowels, and death itself. These symptoms are much more violent, and succeed each other much more rapidly after the bite of a rattle-snake. But when a person is bitten by a cobre-di-capello (hooded snake) he dies in an hour, his whole frame being dissolved into a putrid mass of corruption. A young cadet had a narrow escape from this last dreadful fate

some years back; he was in the act of drawing on one of his boots, when he fancied he heard something in motion inside, and on throwing it down a cobra issued from it, which was killed without injuring any one. The whip-snake is equally venomous with the hooded snake. One of the Jesuit Missionaries happening to enter into an Indian pagoda, saw what he took to be a whip-cord lying on the floor, and stooped to take it up; but upon handling it, what was his surprise to find that it was animated, and no other than the whip-snake, of which he had heard such formidable accounts. Fortune, however, seemed favourable to him, for he grasped it by the head, so that it had no power to bite him, and only twisted its folds up his arm. In this manner he held it until it was killed by those who came to his assistance.

A poor lad, on board one of our ships of war on a foreign station, was not so fortunate as the missionary; he took up a whip-snake, which had by some means got into the ship, thinking it was a cord, but was bitten by it, swelled to an enormous size, and died within twelve hours. His body was in such a state of decay as to oblige his being thrown overboard immediately."

A modern writer states an instance of the bite of a viper, from which the patient swelled very much, with other dangerous symptoms, but was cured by the application of cupping-glasses to the wound.

A negro is said to have had his freedom purchased, and a hundred pounds per annum settled upon him by the General Assembly of Carolina, for the discovery of the following remedy for the poison of a rattle-snake:—Take of the roots of plaintain and horehound, in summer roots and branches together, a sufficient quantity; bruise them in a mortar, and squeeze out the juice, of which give, as soon as possible, one large spoonful; if the patient be swelled you must force it down his throat. This generally will cure; but if he finds no relief in an hour afterwards you may give another spoonful, which never fails. If the roots are dried, they must be moistened with a little water. To the wound may be applied a leaf of good tobacco, moistened with rum. The above is quoted by Buchan, who gives it on the faith of Dr. Brookes.

Terrific as nature has rendered the rattlesnake, the ingenuity and daring of man has yet made this formidable reptile subservient to his will. A Mr. Neal, a Frenchman, some years ago exhibited, in America, two rattlesnakes which he had completely tamed, without depriving them of their fangs. He used to allow them to coil round his neck, and creep about his person, without showing the slightest fear. To convince his visitors that their fangs had not been drawn, he was in the habit of opening their mouths and exhibiting them.

With regard to the stings of the wasp, hornet, and bee, there is not much danger to be apprehended from them, provided the person or animal is not stung by a multitude, then indeed it becomes dangerous, and sometimes even fatal. Oil applied to the part is the best remedy; if that alone should not be found sufficient, the person must take cooling medicines, have poultices applied, or be bled.

Persons have been known to swallow wasps in beer, &c., and to be stung by them in the throat, which has produced most dangerous strangulation or choking; the remedy is honey, sweet oil, and vinegar, mixed together, and a spoonful to be swallowed every minute until relief be obtained.

The sting of the scorpion of Europe, although severe, is nothing compared to that of Africa. Travellers in that country assert that it is found as large as a lobster, and its bite often occasions death. The natives, when bit, rub the part with a piece of iron or stone, until the flesh becomes insensible. We should not be inclined to trust to that course alone, but should apply the same external and internal remedies as are recommended for the bites of other poisonous animals. The same medicines are applicable to all.

The centepede inflicts very dangerous wounds. Buffon says a sailor, who was bit by one on board a ship, felt excessive pain, and his life was supposed to be in danger; however, he recovered by the application of three roasted onions to the part, and was soon quite well.

VANDERKISTE, JUN.

Poisonous effects of Oxygen.—Most of the metallic oxides are poisonous, and derive this property from their union with oxygen. In general, oxygen, in a concrete state, appears to be particularly destructive in its effects on flesh or any animal matter: and those oxides are most caustic that have an acrid burning taste, which proceeds from the metal having but a slight affinity for oxygen, and therefore easily yielding it to the flesh, which it corrodes and destroys. Painters, therefore, cannot be too particular in regard to cleanliness. They should always wear gloves (often cleaned) when at work. B.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, Feb. 27, R. Ogilvie, Esq., on Insects.—Friday, March 1, election of Officers. At half-past Eight, precisely.

Tower Street Mutual Instruction Society.—Monday, Feb. 25, Mr. Hotine—Question—Are the Principles of Socialism practicable? At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, Feb. 26, — Wilson, Esq., on the practice of Painting, Modelling, and Engraving. At half-past Eight.

Poplar Institution, East India Road.—Tuesday, Feb. 26, Mr. Ogilvie, on Animal Mechanics.—Friday, March 1, Discussion—Formation of Character.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 28, James Mitchell, L.L.D., on the History of Turkey. At half-past Eight.

Society for Promoting Practical Design, Saville House, Leicester Square.—Monday, Feb. 25, G. Foggo, Esq., on Composition. At a quarter past eight.

London Temperance Institute, 167, Fleet Street.—Friday, March 1, Mr. Dart, on the non-existence of alcohol in any natural production. At Eight.

Greenwich Society, 15, Nelson Street, Greenwich.—Tuesday, Feb. 26, Mr. Dickson, on the pleasures and advantages of the Study of Plants."

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—I am about making an electrical air cannon, and should like to know whether the barrel would not do if made of a glass tube closed at one end; and whether the piece of ivory, that the knob passes through, is of any service to it? T. S. F.

Sir,—Can you, or any of your readers, inform me of the dimensions of the cylinders in Mr. Hancock's steam phaeton? AMICUS.

Sir,—Being about to construct a small model of a steam-engine, I should feel obliged by your informing me of the simplest mode of letting the steam above and below the piston. I likewise request a receipt for Congreve matches? A. B.

Sir,—Will any of your readers inform me of a cheap method of making blacking? Also, the method of preparing water-colours? S. W.

Sir,—Can you, or any of your able correspondents, inform me where the copper wire covered with silk may be purchased, which is used for shock batteries, and at what price? I am well aware that it may be obtained at Palmer's in Newgate-street, but the price is enormous. C. C.

Sir,—I should feel obliged if you, or any of your correspondents, could inform me of the best method of extracting paint from wire blinds.
G. H. G.

Sir,—Can any of your correspondents inform me, the method of painting the transparent slides for a magic lantern, with the colours used, &c.?
HOWARD.

Sir,—Permit me to ask whether any of your numerous correspondents can inform me how the colours are prepared for transparent blinds? T. L

ANSWERS TO QUERIES.

Sir,—I beg to inform "A Subscriber" that if it is not convenient to call on me for the information on the velocipede, offered in a former number, that he may, by attending to the diagram of one that appeared in No. 96, and to these few remarks, be able to construct one similar to mine. First, that there be three wheels, two of which should be three feet in diameter, and the third one foot eight inches, and be guided by the feet of the rider. The two large wheels should be fixed on an axle of one-inch iron, three feet six inches in length; at the centre of the axle is a crank, of five inches, and is connected with a rod and lever, the former fourteen inches in length, the latter eighteen. The lever is passed through the beam or pole, as seen in the diagram, the fulcrum of which is adjusted by a number of holes made for that purpose. I should have remarked, that my lever is so contrived that it can be taken off, about six inches from the top; and it has a cross head, which I find more convenient to be worked by hand. The seat of mine is a sort of box, with a little rail on the top, and is fixed on a part of the beam or pole, at such a distance from the fore wheel as I have found, from experience, most convenient. I shall feel most happy in supplying any further information to your correspondent should he stand in need of it. J. L.

Sir,—I beg to inform "N. B." No. 6, that Schele's method of obtaining acetic ether, was to mix acetate of potash, or of lead (sugar of lead) or of copper (distilled verdegris) with alcohol, and then adding as much sulphuric acid as is requisite to decompose the acetous salt. This was distilled at a low heat, and the produce being shaken, with water, the ether rose to the surface, and was poured off. From sixteen parts of sugar of lead, six parts of sulphuric acid, and nine of alcohol, Bucholdtz obtained six parts of pure rectified ether. F. P.

TO CORRESPONDENTS.

N. B. *If he will explain his meaning more minutely his query shall be either answered or inserted. What does he mean by "putting quicksilver into little holes, so as to form flowers?"*

T. H. *We have to thank him and several other correspondents for their information on the subject of producing oxygen gas; they will see that we have inserted an article which embodies nearly all the processes they have described.*

Libra, Manchester, *wishes an answer to the following question:—"A invents a plan for producing a certain article in less time than had previously been done.* B, *without the knowledge of* A, *took out a patent for a similar improvement* nine months before. A *made his machine from one in the possession of a private person, who used it for domestic purposes, not having any knowledge of* B's *patent.* A *can bring proof that he knew nothing of* B's *patent at the time. Can* B *sue* A *for using his machine?" The use of the machine by* A *is an infringement on* B's *patent; if it could even be proved that* B *had copied his machine from that of* A, B *would still retain his right. It would be difficult to frame a law which would operate equitably in all instances; but it would be still more difficult to contrive a worse one than the present. "Dura lex sed lex."*

Proportio. *We shall be glad to receive the papers he mentions on architecture.*

Aleph *is wrong; if a pint of alcohol be mixed with a pint of water, the compound will not measure two pints; a chemical union takes place, during which heat is evolved; and when that has subsided, it will be found that there is considerably less than two pints.*

We have to acknowledge the favours of numerous correspondents, all of which will be either inserted, or otherwise attended to.

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THE

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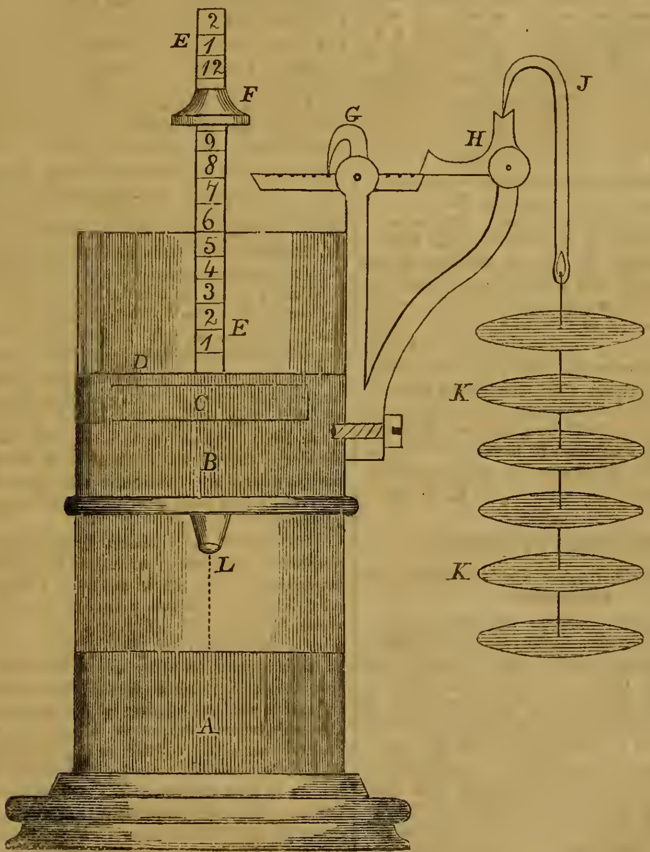
A MAGAZINE OF THE ARTS AND SCIENCES.

No. X. NEW SERIES. | SATURDAY, MARCH 3, 1839. (PRICE ONE PENNY.) | No. CXXX. OLD SERIES.

HYDROSTATIC TIMEPIECE.



City Press, 1, Long Lane, Aldersgate Street: D A Doudney.

HYDROSTATIC TIME-PIECE.

(See Engraving front page.)

Description of the Engraving.— A and B are two tin cylinders, soldered together, and communicating by means of a small aperture at L; water is poured into the upper compartment, into which is inserted a float, C, bearing a graduated cylinder, E E, and a moveable slide, F; as the water drops through the aperture, L, the float descends, and the hour is indicated by the point of the detent, G. It is also an alarum. The moveable piece, F, being set to any required hour, will, when it presses upon the detent, G, raise the piece H, and throw the point upon which J is supported beyond the centre of motion; so that, by its own weight, it will overturn the piece H, and fall with K K, which are plates of metal, suspended on a string, and by striking together, produce sufficient noise to awaken almost any person, especially if made to fall from a considerable height. The float should be made of cork, or some light substance, coated, so as to prevent the water from penetrating; and a plate of metal, D, be attached to its upper surface, so as to immerse it till it descends to the level of the water. By this means, its action becomes more instantaneous and certain upon the detent, G, as the whole weight of the metal plate is opposed to the rising of the float. The aperture, L, should be made of brass, with a broad opening on the upper side, and covered with fine muslin, to prevent small particles of matter from lodging in the hole. It should be placed close to the side of the cylinder, to prevent the noise which would otherwise be occasioned by the dropping. Q. E. D.

DAGUERRE PICTURES.

MR. TALBOT'S CLAIM OF PRIORITY OF INVENTION.

M. Arago has read to the French Academy of Sciences a letter from Mr. Talbot, in which he announces that, having been informed of the communications recently made to the academy on the invention of M. Daguerre, he intends shortly to address to that learned society a claim, tending to establish his right to priority of invention. M. Arago remarked that Mr. Talbot had probably an imperfect knowledge of the communication made to the academy; without this supposition, it would be difficult to conceive how he could claim priority for a discovery which is to be the subject of a memoir not yet read. He says, indeed, that he discovered the process in 1835; but without pretending to revoke in doubt, the exactitude of this assertion, in support of which Mr. Talbot will no doubt produce sufficient proof, it is known, from what has been already communicated to the academy, that at a much earlier period M. Daguerre had obtained very satisfactory results—results which very few would have imagined it possible to surpass; but to an artist like him, they left something still to desire.

It was to give to his process all the perfection of which he perceived it was capable, that he continued to labour in silence, exposing himself to be anticipated by some other. "I say anticipated," added M. Arago, "and not surpassed; for this process is not one of those which are discovered by hazard, and which are, from the first instant, what they will always remain. I know M. Daguerre's mode of operation, and I declare, that when it is rendered public, it will excite as much admiration by the series of artifices employed, as by the perfection of its results. These results, all the members of the academy, and many distinguished painters, have seen; for I repeat, Mr. Talbot has been misinformed when he believes that M. Daguerre has only announced a discovery; he has presented his productions."

With respect to the date, it must be recollected that, for fifteen or twenty years past, MM. Niebs and Daguerre have laboured, first separately, and then concurrently, to arrive at the end which they had already each of them a just hope to attain. The union of their efforts dates from 1829; it has led to a treatise written between them, an authentic document, which proves at what point they had then arrived, since their processes are there described.

The results of these early attempts are preserved; and there are some which were produced as far back as 1815 and 1816. At this period the two principal conditions were fulfilled; the fixing of the image, and preservation of the design, without further alteration after the completion of the process. There were, nevertheless, obstacles still remaining to be overcome; the substances employed were not sufficiently sensible to the action of light; twelve hours were required to obtain that which is now obtained in a few minutes—the complete discolouration of the luminous parts of the image. Thus, if it were required to operate in a single day, a correct sketch would be produced, but not an exact relief; for during this time, the sun changed its position; the shadows were displaced, and the contour alone was cor-

rect. Even supposing that the light were made to act during several days, and at nearly the same hour, keeping the picture in darkness while the operation was suspended, there still remained in the process of M. Niebs this inconvenience—that the designs so formed presented only oppositions of light and shade, and no intermediate tints. The Daguerre process, far superior to this, existed in 1829, with all its essential characteristics.

It has been said, that the sentiment of an artist had stimulated the inventor to continue his researches, after he had arrived at a result which would have satisfied an ordinary experimentalist; but it may be supposed, that the improved process requires the dexterity of an artist to apply it with success. If that had been the case, the utility of the invention would have been confined to a small number of practical artists, who might have studied that particular operation. This fear is without foundation. M. Arago states, that he has employed this process according to the directions of M. Daguerre, and though entirely unacquainted with the art of drawing, he produced, in ten minutes, in dull, unfavourable weather, a magnificent view of the Boulevard du Temple.

There was, amongst the objects which presented themselves to the sight, and which were pourtrayed in the camera obscura, a house, with a lightning conductor. According to a well-known law, this conductor ought to subtend too small an angle in the design to be visible to the naked eye. If it had been seen in the picture, the drawing would have been incorrect; that is to say, it would have been represented larger than it ought to have been, according to the rules of perspective. It was not seen; but although it was imperceptible to the naked eye, it was traced by the action of light, and discovered with the aid of a magnifying glass!

METEOROLOGY.

Mr. Torbes has addressed a letter from Edinburgh to M. Arago, relative to the observations he has made on the manner in which the sun colours the column of steam which escapes from a locomotive; the different tints exhibited by these columns varying according to the distance from the orifice, and the tension of the steam in the boiler, appear likely to furnish the explanation of the prognostics relative to rain and fair weather, founded upon the colour which the sky presents in the evening, in that part of the horizon where the sun sets—prognostics which meteorologists have often been compelled to acknowledge as correct, though they have not been able to explain the cause of the phenomenon. Persons engaged in agricultural labour, and who are accustomed to make observations upon the weather, although they cannot absolutely foretel an approaching change, do, nevertheless, prognosticate with very frequent success. This is not a vulgar prejudice; for Lord Byron, who was very far from being either vulgar or credulous, speaks of

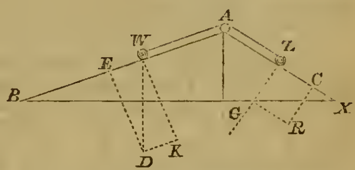
> "The evening beam that smiles the clouds away,
> And tints to-morrow with prophetic ray."

ON THE MECHANICAL POWERS.

NO. VII.

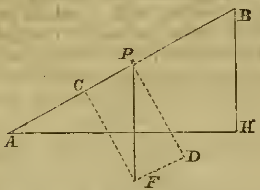
(Continued from page 53.)

It sometimes happens that a weight upon one inclined plane is raised or supported by another weight upon another inclined plane. Thus, if A B and A X,

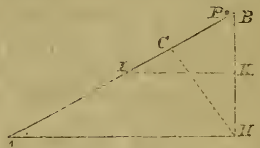


be two inclined planes, forming an angle at A, and W Z be two weights, placed upon these planes, and connected by a cord passing over a pulley at A, the one weight will either sustain the other, or one will descend, drawing the other up. To determine the circumstances under which these effects will ensue, draw the lines W D and Z R in the vertical direction, and take up on them as many inches as there are ounces in the weights respectively, W D and L R being the lengths thus taken, and therefore representing the weights, the lines W E and Z C, will represent the effects of these weights respectively down the planes. If W E and Z C be equal, the weights will sustain each other without motion. But if W E be greater than Z C, the weight W will descend, drawing the weight R up. In every case the lines W K and Z G will represent the pressures upon the planes respectively. It is not necessary, for the effect just described, that the inclined planes should, as represented in the figure, form an angle with each other; they may be parallel, or in any other direction, the rope being carried

over a sufficient number of wheels, placed so as to give it the necessary deflection. This method of moving loads is frequently applied where railroads are used; loaded waggons descend one inclined plane, while others, either empty, or so loaded as to permit the descent of those with which they are connected, are drawn up the other. If a body, P,



be placed upon a plane, A B, oblique to the direction of the force of gravity, then the weight of the body will be distributed into two parts, P C and D D; P C producing motion down the plane, and P D producing a pressure on the plane A B. Since the obliquity of the perpendicular direction, D F, of the weight to that of the plane, A B, must be the same on whatever part of the plane the weight may be placed, the proportion, P C, of the weight which urges the body down the plane, must be the same throughout its whole descent. Hence it may be inferred, that the force down the plane is uniform; for since the weight of the body P is always the same, and since its proportion to that part which urges it down the plane is the same, it follows that the quantity of this part cannot vary. The motion of a heavy body down an inclined plane is therefore an uniformly accelerated motion. Since P F represents the force with which the body should descend freely in the vertical direction, and P C the force with which it moves down the plane, it follows that a body would fall freely in the vertical direction, from P to F, in the same time as on the plane it would move from P to C Therefore, when the height through which a body would fall vertically is known, the space through which it would descend in the same given time, down any given inclined plane, may be determined. Let A B be the inclined plane, and let P F be the space through which the body would fall in one second; from F draw F C perpendicular to the plane, and the space P C is that through which the body P will fall in one second on the plane. As the force down an inclined plane is less than that which urges a body falling freely in a vertical direction, the space through which the body must fall to attain a certain final velocity, must be just so much greater as the accelerating force is less. Suppose the body P placed at the top of the plane, and



from H draw the perpendicular H C. If B H represent the force of gravity, B C will represent the force down the plane. In order that the body moving down the plane shall have a final velocity equal to that of one which has fallen freely from B to H, it will be necessary that it should move from B down the plane, through a space which bears the same proportion to B H as B H does to B C. But since the triangle A B H is in all respects similar to H B C, the line A B bears the same proportion to B H as B H bears to B C. Hence, in falling on the inclined plane from B to A, the final velocity is the same as in falling freely from B to H. It is evident that the same will be true at whatever level an horizontal line be drawn. Thus, if I K be horizontal, the final velocity, in falling on the plane from B to I, will be the same as the final velocity in falling freely from B to K.

Examples on the Inclined Plane.

1. Required the power capable of moving a weight of 300lbs. up an inclined plane, 50 feet long and 16 feet high?

As 50 : 16 : : 300 : 96lbs. power.

That is, $300 \times 16 = 4800 \div 50 = 96$.

2. A power of 120lbs., with a velocity of 50 feet per minute, is to be applied to move a weight up an inclined plane at the rate of 30 feet per minute; the plane is 25 feet long and 8 feet high; required the weight that the power is equal to?

$120 \times 50 = 6000$, and $30 \times 8 = 240$: then

As 240 : 25 : : 6000 : 625 lbs.

That is, $6000 \times 25 = 150{,}000 \div 240 =$ 625lbs.

A. D. M.

PERPETUAL MOTION.

THERE are three ways in which the words "Perpetual Motion" can be taken.—1st. In their literal meaning, a motion to last *for ever*. 2nd. A motion to last till the end of time. 3rd. A motion to last

till the materials of the machine are worn out, or till overcome by friction. The first cannot, of course, be obtained by material things, these must cease at the end of time, if not worn out before. Even the motion of the universe *would not* be perpetual; in a certain number of years it would be brought to a stand-still by the continual resistance of the air. The soul of man is perhaps the only instance of this kind. The second has never yet been obtained, unless indeed we take the earth itself as an example. The duration of time not being known, and as a machine can only be made to last a certain time, it is possible that one could be made to last so long, though we cannot be certain that it *will* last. Of the third there are many instances, both in nature and art; one of which is a soap bubble sailing in the air till it bursts.

Thus we see that this apparent anomaly, this "philosopher's stone," can be reduced to a simple mechanical problem, viz. to obtain a *self-acting* machine, to last till friction overcomes the motion; and, of course, the chief aim will be to lessen the friction as much as possible.

FORMATOR.

ACCIDENTS ON RAILWAYS.

ACCIDENTS are frequently happening to passengers by railways, on account of their foolish temerity in jumping out of the carriages to recover anything they may have dropped; this they of course do involuntarily, and by a momentary impulse; but it would be well if persons would impress their minds with the almost inevitable destruction which awaits them should they do so. An accident of this kind lately happened on the London and Birmingham Railway to the servant of Lady Baring, who happened to drop his hat, and jumped out to recover it, although the train in which he was riding was progressing at the speed of thirty miles an hour. He would inevitably have been killed, had he not fortunately fallen into a pond. There is another accident recorded in to-day's *Times*, of a drunken man jumping out of one of the carriages, and being found an hour or two after very much bruised. Surely it is very reprehensible in the Railway Directors, to allow the possibility of such a disaster to exist.

The precise amount of the danger of railroad travelling, even at the commencement of the experiment, will at once appear to have been only about ten passengers killed out of more than forty-four millions.—*Quarterly Review.*

Query. Is this a mistake or a falsehood? Surely it must be one or the other.

GAMMA.

[A person unaccustomed to alighting from a carriage in motion, is almost certain to fall if he attempt to do so at a speed of eight or ten miles an hour. It is extremely dangerous to quit a carriage while proceeding with a velocity exceeding twenty miles an hour; the feet being suddenly arrested, while the upper part of the body is impelled forwards by its momentum, throws the head with great violence to the ground. We were ourselves witness to an accident of this kind some time ago, when upon an excursion on the Liverpool and Manchester Railway. The train was not going at its full speed, having slackened in approaching to Newton; they were probably proceeding at the rate of about sixteen or eighteen miles an hour, when a young man, a passenger, imprudently leaped out, and was the next instant extended motionless on the earth. We, however, afterwards ascertained, that he received no permanent injury. The statement in the *Quarterly Review* we believe to be accurate; at least we have no more authentic source to refer to, than that from which the above was derived.—ED.]

LONGEVITY.

To the Editor of the Mechanic and Chemist.

SIR,—As a sequel to "Q. E. D's." letter on "Longevity," I send a prospectus, taken by a friend during his sojourn in Russia, showing the average numbers that die, having passed the age of 100 years; and which may prove interesting to your readers.

690	died between the age of	100 and	105
149	....	105 ...	110
93	....	110 ...	115
49	....	115 ..	120
46	....	120 ...	125
6	....	125 ...	130
7	....	130 ..	135
2	....	135 ...	140
3	....	140 ...	145
1	....	145 ...	150

Some Russians attain a greater age than 150 years; but being very few, in comparison to the above list, I have not placed them in it.

I am, Sir,

Your's respectfully,

ARCHITECTOR.

ROYAL INSTITUTION.

THE GYMNOLUS AND TORPEDO.

At the first evening meeting for the season, Dr. Faraday delivered a lecture on the electric powers of the gymnolus and torpedo. The first part was devoted to an illustration of the phenomena of electricity, and those which more particularly related to its action and influence on organic bodies. Various experiments on the torpedo had illustrated the analogy of its action with that of the electrical machine, more particularly in the production of sparks and the formation of a magnet. The most minute anatomical investigation had shown, that both in the electric ray and eel, the parts containing the apparatus that produced a shock, was an appendage not essential to its vitality, and that, in fact, the animal obtained greater vivacity when this source of nervous action was removed. The anatomy of the gymnotus was still more wonderful than that of the torpedo, its powers of vitality and motion being confined to a small portion in the upper part of the body, the rest containing the electrical apparatus. The investigation that had already been made, held out a hope that their further prosecution would tend to a greater elucidation of the nervous power, and, as the portions in question might be removed without inflicting pain or injury upon the animal, it would be desirable to see how far electricity would restore these powers. The meeting was very numerously attended.

Gamma.

THE QUEEN VICTORIA STEAM ENGINE.

When in London, I was favoured by having one or two articles inserted (one under the head of steam slide), I have, therefore, sent the following account, considering it applicable to your pages.

A most beautiful engine has been erected at the Pontesbury lead mines, near Shrewsbury, by the Coalhrookdale Company (to whom Mr. Samuel Cookson, principal engineer, under whose superintendence it has been got up, great praise is due), it is to work in that invaluable lead mine called the Bog Mine, to conquer the deluge of water which had usurped the mines, and stopped the working of them.

On Friday, January 25th, this splendid engine was put in motion. The following is an account of it:—Length of the beam, 35 feet 10 inches; length of the stroke of the piston, 10 feet; internal diameter of the cylinder, 70 inches; bore of pump pipes, 18 inches; depth of the engine shaft, 315 yards, the water being raised to a level 100 yards below the surface. About one o'clock, this grand piece of machinery began to have fresh fuel added to its boilers, and for several moments the spectators were breathless with anxiety, till the beam lifted its majestic head, and S. Cross, Esq., of Chester, one of the proprietors, named her the *Queen Victoria*, amidst the tremendous cheerings of a vast multitude; the band playing "God save the Queen." Several hogsheads of ale, and bread and cheese, were distributed to the workmen and the multitude, whilst numbers sat down to dinner in the Company's offices. After dinner the usual loyal toasts were given and drank with enthusiasm; afterwards "The Bog Mine Company, and prosperity to their undertakings." Mr. Cross, in a neat and appropriate speeeh, thanked them for himself and partners; and in the course of his speech he spoke in high terms of the Coalbrookdale Company, for the honourable and very efficient manner in which they had fulfilled their contract, &c. The engine was reckoned as 140-horse power, but it is capable of being worked to 370-horse power.

I remain yours, &c.

Coalbrookdale, Salop. J. C.

Cohesion.—Coulomb found the lateral cohesion of brick and stone only 1-44th more than the direct cohesion, which, for stone, was 215 pounds for a square inch; for good brick from 280 to 300. Supposing this lateral cohesion constant, a pillar will support twice as much as it will suspend, and its angle of rupture will be 45 degrees. From the same supposition it may be inferred, that the strongest form of a body of given thickness for supporting a weight, is that of a circle, since the power of the weight in the direction of every section varies as the length of that section, and the strength is therefore equal throughout the substance. But, if the cohesion be increased, like friction, by pressure, and supposing, with Amontons, that this increase, for brick, is, is three-fourths of the weight, the plane of rupture of a prismatic pillar will form, according to Coulumb, an angle of 63 degrees 26 minutes with the horizon, and the strength will be doubled. On both suppositions the strength is simply as the section. It is of the less consequence to investigate the lateral pressure of soft materials, as they are generally liable to be penetrated by water, which acts according to the laws of hydrostatics.—*Adcock's Mechanic's Pocket Book.*

THE CHEMIST.

ELECTRICITY, No. I.

Our knowledge of this science is but of comparatively modern date: the only fact which the ancients appear to have known concerning it is noticed by Thales, the Milesian, who lived about 500 years before the Christian era. He observed that when a piece of amber was excited by friction, it possessed the property of attracting feathers, and other light bodies, to its surface. This phenomenon he accounted for by supposing that the amber possessed an inherent soul or spirit, which, when excited by friction, went forth and collected the particles which surrounded it. It is to this circumstance that the science owes its name, "Electron," being the Greek name for amber. Nothing further appears to have been known of the science until the commencement of the 17th century, when it was found that sulphur, glass, resins, and a number of other substances, possessed the same powers as amber. It was next discovered that the electricity thus produced was capable of being transferred to other bodies, which then exhibited the same phenomenon; but this was not always the case, for if the body it was intended to electrify was connected with the ground by certain substances, such as metals, saline solutions, acids, common water, &c., no effect took place; but if the body were supported on glass, shell-lac, sulphur, and various other substances, the effects invariably appeared. These facts gave rise to the distinctions of conductors and non-conductors; the former class allowing the electric fluid to pass freely along them, were termed the conductors, and the latter appearing to resist its passage, were called the non-conductors. Previous to this, it was found that the electricity evolved by different bodies was not alike in its properties; for when a pith-ball, suspended by silk (a non-conductor), was excited by being touched by an electrified glass rod, and then brought near another pith-ball, electrified by a stick of sealing-wax, and suspended in a similar manner, they were strongly attracted by each other; but if both the balls were excited by either the glass or wax, the reverse happened; for they then immediately repelled each other. To account for this, a philosopher, named Dufay, supposed that there were two kinds of electricity; that which was exhibited by glass he termed the *vitreous*, and the other, which appeared by the excitement of sealing-wax, he termed the *resinous*. This theory appeared so plausible, that it was immediately adopted by all the philosophers in Europe, until about the middle of the last century, when the celebrated Dr. Franklin, from his experiments on this subject, arrived at the conclusion that the effects produced by electric agency might be easily accounted for, by supposing them to be caused by only one fluid, existing either beyond or below its natural proportion in any body. Before we proceed to examine his views, it will be necessary to notice the means which were shortly before then invented for the accumulation of greater quantities of electricity for experiments, which I shall do in my next paper on this subject.

Electron.

Production of Microscopic Eels in Paste.—To procure these beautiful living objects, nothing more is necessary than to make a paste of boiled wheaten flour, and suffer it to remain till it becomes sour; when it will shortly become filled with the eels. This paste needs to be kept moistened with water, and to be occasionally replenished with a supply of fresh paste; and, in this way, one may have a constant supply for six months. When wanted for use, enough should be taken as would lay on a pin's head, and immersed in water.

G. Nash.

To make Glue from Tanned Leather.—The glue from tanned leather is made as follows: Boil the scraps or cuttings of thin, tanned leather, such as the upper-leathers of boots, shoes, &c., are made of, in lotium, until they become softened, and will stretch and contract, when pulled, and let go again, in the manner of India-rubber; they are then to be washed in clean water, and boiled in water, until dissolved to a proper consistence for use. This glue is exceedingly convenient for making the black paper cases, so much used for a great variety of purposes; as it not only forms the cement, by which they are glued together, but also, in consequence of the gallic-acid contained in it, strikes a black colour, by the application of a solution of sulphate of iron (green vitriol, or copperas,) to the surface of the articles; and lastly, serves to varnish the cases.

G. Nash.

Electrified Camphor.—If a spoon, holding a piece of lighted camphor, be made to communicate with the prime conductor of an electrical machine, while the conductor continues to be electrified the camphor will shoot like a vegetable. E. G—y.

A Fire which cannot be extinguished by Water.—Take of gunpowder five ounces, saltpetre three ounces, brimstone two ounces, camphire, rosin, and turpentine, one ounce each; mix all together; wet it with oil of rosiny fir tree; if balls be filled with this composition, and then thrown into water, and even if buried under the earth still will they burn. E. G—y.

Sub-Aqueous Volcano.—Take one ounce of saltpetre, 3 oz. of powder, 3 oz. sulphur vivium, beat, sift, and mix them well together; then fill a paper mould with the composition, light, and immerse it in a bason of water, when it will burn *under water* till quite spent.

R. T. N.

Artificial Volcano.—Mix equal parts of powdered sulphur and iron-filings, form it into a paste with water, bury it at about six inches below the surface of the earth; in about ten or twelve hours' time, if the weather be warm, the earth will swell up and burst, and flames will issue, which will enlarge the aperture, strewing around a black and yellow dust. The quantity is two pounds of each. E. G—y.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, March 6, Quarterly General Meeting. At half-past Eight, precisely.

Tower Street Mutual Instruction Society.—Monday, March 4, Mr. Lea, on Chemistry. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, March 5, Dr. John Walker, on Physiology. At half-past Eight.

Poplar Institution, East India Road. — Tuesday, March 5, Mr. Davis, on Respiration.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 7, John Christopher Bowles, Esq., on Lithography. At half-past Eight.

Society for Promoting Practical Design, Saville House, Leicester Square, Monday, March 4, B. R. Haydon, Esq., on Painting. At a quarter past eight precisely.

London Temperance Institute, 167, Fleet Street.—Friday, March 8, Mr. G. White, on Meteorology. At Eight.

Greenwich Society, 15, Nelson Street, Greenwich.—Tuesday, March 5, Mr. Elliott, on Physical Education. At eight precisely.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—Could you, or any of your correspondents, inform me, through the medium of your valuable magazine, the following queries:—Having purchased a cylinder for an electrical machine, I should wish to know how to fasten in the spindles as the opticians do. Likewise, if baked wood is indispensible for the uprights of the machine; if so, where could I purchase it, or could you inform me how to prepare it. Likewise, the best and cheapest work on electricity, with experiments for A BEGINNER.

Sir,—I shall feel much obliged if you, or some one of your numerous readers will inform me how I may make really good blacking. I have tried several ways, but none of them have proved satisfactory. I should like also to know the best way of making a hygrometer. IMPRIMATUR.

Sir,—I shall feel particularly obliged by an early answer from you or any of your correspondents, to the following questions:—How to construct a neat and cheap bellows for a blow-pipe? what should be the size of the nozzel of the blow-pipe for the purpose of operating upon glass tubes? I presume it must be considerably wider than what is required for soldering metal. Any other information respecting the blowing of balls, soldering, sealing, &c., of barometer tubes would be highly acceptable. In constructing a weather-vane, ought the spindle to be fixed exactly in the centre of gravity of the vane, or not?

J. Y.

Sir,—You will oblige me by inserting the following queries:—1, What is the smallest effective size of which a steam-boat-engine may be made? The least boat and engine of which I am aware, is the "Pink," of six-horse power, and I believe of four tons, used in summer-time to ply between London Bridge and Vauxhall. 2, What is the relative proportion between the tonnage of a boat, and the horse-power of the engine, and between the horse-power of the engine, and the size of the boilers? 3, I should wish to be informed of a plain and simple rule for computating the tonnage of a vessel, as those of which I am aware are exceedingly intricate. EBLIS.

TO CORRESPONDENTS.

J. Evans. *Pure water may be preserved by adding a very small quantity of alcohol; one hundredth of its volume, or even less, will keep it bright. The bright-coloured liquids in the chemist's windows, are chiefly metallic solutions; the blue is a very weak solution of sulphate of copper, and ammonia; they require frequent filtering before they become permanently bright. Water may also be preserved by various salts and acids, but they of course render it unfit for drinking.*

A Reader. *Hair dye is, or may be, made with the nitrate of silver.*

R. T. N. *wishes to be informed where he can obtain the stone called* lapis calamindaris, *or (zinc stone). Some of our correspondents will no doubt be obliging enough to answer this question; but we fear he will be disappointed in the result of his experiment, viz. "that by saturating aquafortis with iron filings, and putting in a lump of lapis calamindaris, the stone will be kept in continual motion." Shell-lac is a good cement for joining glass and brass together. when the two parts can be made sufficiently hot to melt it; if not, it may be dissolved in spirits, and applied cold; but it requires a considerable time to become hard and dry.*

J. Banks. *In our next we shall be able to give an exact description of a method of fixing the image of the camera obscura.*

We have received several papers which we shall endeavour to make room for next week.

D. C.. *and several other Correspondents who have made similar inquiries, are informed, that a Frontispiece to each volume of the "Mechanic"* HAS BEEN PUBLISHED, *and is circulated gratuitously to every purchaser of the Title and Index of the volumes. If any difficulty is found in obtaining it, apply at once to the Publisher.*

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THE
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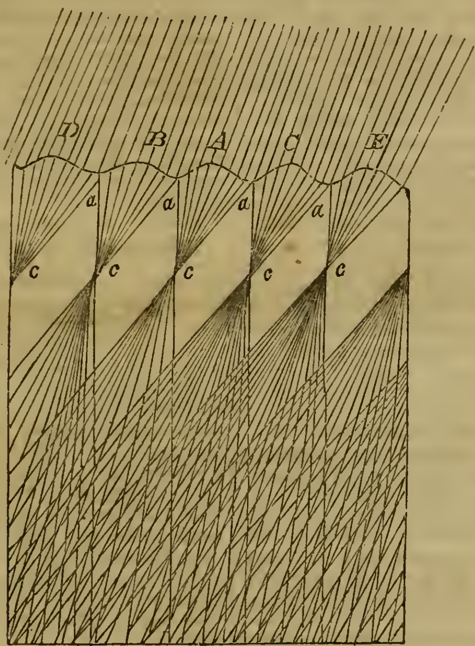
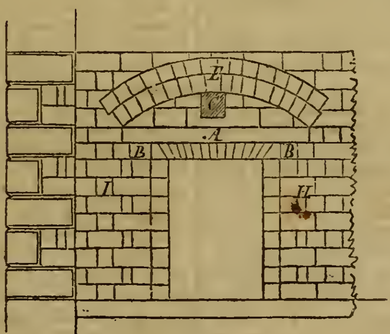
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XI. NEW SERIES. | SATURDAY, MARCH 9, 1839. (PRICE ONE PENNY.) | No. CXXXII. OLD SERIES.

RAYS OF LIGHT IN WATER.



WINDOW ARCH.



City Press, 1, Long Lane, Aldersgate Street: D. A Doudney

RAYS OF LIGHT IN WATER.

(See Engraving front page.)

Visible rays of light are formed in any body sufficiently transparent to allow the *direct* flow of sunbeams, or of any other intense light, and possessing at the same time a sufficient degree of opacity to render their presence palpable, as it were, to the sense of vision. These two conditions are united in an atmosphere charged with aqueous vapours, smoke, or dust, &c.; and it is on such semi-transparent matter, that the appearance of rays most commonly depends. Water is not only one of the most transparent bodies, but it is saturated with small colouring particles, to a degree quite sufficient to render the passage of light through this medium apparent; and if rays are but seldom seen, it is in a great measure owing to its being somewhat too inconvenient to attain a proper place for observation, as the light reflected by the surface of the water, renders any position above its level, unfit for observing effects produced beneath it. I have, however, distinctly seen rays of light penetrating into the depths of a river, in a spot where the arch of a bridge greatly diminished the quantity of light reflected by the surface of the water, and added, at the same time, to the contrast of the sunbeams thrown into it from under the arch. I have witnessed another instance of rays of light under water, on the lake of Thim, in Switzerland, in a part quite open to the sun. The lake was very transparent, though of a blueish hue, ascribed to particles of primitive rock, worn off by the torrents. The surface of the water was ruffled by irregular waves, from which rays appeared to descend to a distance of several feet, in a direction opposite to that of the sun. It was difficult to observe, owing to the motion of the water, of the boat, and of the rays themselves, to what part of the wave each of the latter corresponded; but I conclude that their formation may be attributed to the conveying power of the spherical portion of the wave acting as a plano-convex lens. The annexed diagram, representing a vertical section, will show that the concentrated rays would present inverted cones, A A A A, which are succeeded by others in an opposite direction, and that on penetrating further into the water, they would form a rhomboidal shape, occasioned by their being traversed by the rays successively arriving from more distant waves, B C D E, &c., the number of these which contribute rays to each of the figures, increasing with the distance from the surface of the water. Yet, independently of the general divergence of the rays below the foci, C C C C C, which would alone prevent any increase of light towards the bottom of the water, the luminous figures would become progressively fainter; partly from the general absorption of light, and partly because a more equal diffusion of light, produced by a successive accession of rays from different directions (see diagram), lessens that contrast between one portion of the fluid and another, on which the formation of visible rays solely depends.

As an instance of the convergence of the sun's rays in traversing the surface of waves, may be mentioned the luminous and beautiful appearance seen on the sandy bottom of a clear stream rippled by the wind. It is when the distance between the surface and the bottom of the water nearly corresponds with that of the wave from the focus of the rays, that these sinuous and playful forms are the most brilliant.

A Subscriber.

Twickenham, February 18, 1839.

BUILDING.

NO III.

(See Fig. 2, front page.)

I shall commence my third article, by describing, as promised in my last, the arches which are now generally used by builders. The literal meaning of the term arch is the concave part of the building so constructed, that the stones or bricks of which it is composed, bind themselves, and adhere together, without any material under to support them, save the points at the two extremities. The only difference between arches and vaults is, the latter being of greater extent than the former.

Arches are of various forms; being strait, elliptical, and different segments of a circle. The meaning of a semicircular arch is the shape above the springing line, or where the bottom points of the arch touch the side, is half a circle, and which must necessarily contain 180°. *Skew* or *Scheme* arches are much flatter, and generally contain from 60° to 120°. The gothic arch is composed of two arches, and was at first described from each angle of the base of an equilateral triangle; the vertex being the point of intersection. But as there are now so many different degrees, and as they are not used in common buildings, I shall not further describe them; but merely say, they are the strongest kind of arch yet discovered; as the higher the crown, the stronger the

arch will be, and the greater weight it will support.

There are four methods of constructing arches; being plain, rough, cut, and guaged. Plain arches are composed of bricks in their common state, uncut. Rough and cut arches, which are very similar, the only difference being, that in the former the bricks are very roughly, and in the latter more smoothly, cut to a wedge form. These kinds are sometimes termed *axed*, on account of the bricks being cut to the above form by an axe; and in guaged arches, the bricks are very carefully cut and rubbed to a guage, on the same principle that stones for stone arches are formed, so that all the bricks shall fit each other as if in a mould; but this would not be a sufficient explanation, as it only shows the principle of construction, and does not point out their defects and advantages, so that it will be advantageous to comment further on this most necessary, important, and useful branch of the art. Plain arches are very ineffectual, as bricks, being parallelograms, and being so placed that the bottoms touch the centre, and likewise that all the lower angles of the bricks touch each other (which is the proper method), a vacuity will occur between the brick, in a triangular form, the vertex of which is the point where the lower angles of the bricks touch, and which must be filled in with mortar or cement, which dries or sets quicker, almost directly after use, whereas mortar remains unstable for some time. These cavities, occurring as they do throughout the whole arch, for it is not only between two bricks, but throughout the whole arch, renders it very weak where heavy weights are to be placed above, and more particularly in arches of great space; to remedy this defect as much as possible, it is customary, if a nine-inch arch, not to turn it in a whole brick, but in two rows of one-half brick each (vide the discharging arch, E, in the diagram), and the upper row so placed over the other, that the bricks cover the joints between those below, and showing in front like two rows of headers; this is a decided improvement in this kind of arch, as the vacuities are not half so large as they would have been in the other case, and which reduces in a great measure the reliance which must otherwise have been placed on the strength of the mortar or cement.

Rough and cut arches are much more eligible, as the bricks being cut, although roughly, to a wedge form, must, by their binding each other, improve the strength of the arch, and will support almost any weight, as the bricks, being thinner at the bottom than the top, without the whole arch is destroyed, an immense weight would be required to injure any part of it, provided the arch is properly put together. These kinds of arches are generally appropriated for windows and doors when the face of the house is plain; the arch is likewise left plain, but ought (as all arches ought to be) set in cement. But when the front of the house is neatly finished, the arch ought to be pointed and properly finished. Cement is preferable to mortar for arches, as it sets quicker, adheres better, and effectually prevents the wet or damp from getting into it, which is of considerable importance to the strength of the arch. In guaged arches the *soffit*, or underneath part, is generally straight, or has a very slight inclination towards the sides. What I have said concerning the bricks being cut to a wedge form, applies with much greater force to this degree of arch, as the bricks being rubbed to fit as if in a mould, must render it stronger and more effectual, besides producing a much better external appearance than either of the others; but the arches being only half a brick thick, cannot extend their influence any further in the wall, than four and a half inches; and to carry the weight of the brickwork above, a piece of wood, termed *lintel*, at A, in the diagram (which represents the internal elevation of a window, one side of which, H, represents the elevation of the English, and the other side, I, the Flemish bond) is laid across, four inches and a half higher than the intrado, or soffit, of the arch, each end of which rests on a wood brick, substituted in the wall in lieu of common bricks. It sometimes happens, that discharging arches are altogether absent; but this ought not to be, as they always should be turned over the lintel, to throw the weight above as much as possible from the opening. They are sometimes turned over the ends of beams; the space between the arch and lintel is filled up with bricks. C represents the end of a girder (which, although placed directly over the window in the diagram, to avoid the necessity of having two, ought in practice to be avoided), with the discharging arch turned over it, on the principle mentioned under plain arches, as the weight of a girder or large beam resting on a wall, must render the part on which it rests, weaker than the other part which has only itself to support.

POPULAR KNOWLEDGE.

(*Concluded fom page* 60.)

In the last I promised to illustrate my meaning, which, indeed, I think will not be found to be of any great difficulty; for let us inquire into the life and actions of any person whatsoever, who has been at all celebrated for his learning and knowledge, whether his pursuits were of a high mental and abstract character, as that of Newton, Lapace, and others of the same school; of such men as Pope, Dryden, or Reubens, Da Vinci; and amongst artists, if we examine the accounts which biographers have given us of such men as these, how closely shall we find the following words of Locke apply to them, namely, "Most men of those excellencies which are looked upon as natural endowments, will be found, when examined into more narrowly, to be the product of exercise, and raised to that pitch only by repeated actions." And to illustrate this, we may take example of the immortal Newton, who, we are informed by his biographers, when engaged in any particular subject, never suffered himself to be disturbed by any person, and that for days and days he would appear in a complete state of mental abstraction and profound thought; and we also know of the same individual, that in youth he was remarkable for his studious disposition, and more especially after he went to Cambridge, that focus of mathematical learning, and the "native land of the Principia." We are told he mostly prepared himself for the lectures of the professors, by reading the subject attentively the day before the lecture was delivered, by which means he was the better able to follow the professor, and understand his arguments and reasoning the more clearly, and he also made notes and memorandums of any portion of a lecture or a book that he thought might be improved; and it was by this method of close study and constant application, that Newton raised for himself that reputation which he so justly deserves; and the same will apply to La Place, the author of the famous "Mechanique Celeste," a work that, for originality and variety of the subjects of which it treats, is ranked immediately after that of the Principia of Newton. And, as a further instance, we may take that of Abraham Sharpe, the astronomer, who, it is stated, actually wore considerable grooves in his table by using it so constantly; and Kepler himself, in one of his extraordinary works, tells us that his studies had frequently driven him "almost to insanity," and no wonder, for the wild and visionary schemes which he fancied and invented as planetary systems, must have cost him labour which, in fact, I think can hardly be imagined; yet he toiled on, and, after all, fell upon the truth, and discovered those beautiful laws of nature which go by his name, and earned for him the proud and lasting title of the "legislator of the heavens." To any person half philosophical, half imaginative, if I may be allowed such a phrase, the works of Kepler will afford a rich treat; and I know not of any other philosophical works that are treated in such a curious original style.

Again, we are told of Emerson, the eccentric mathematician, that he knew nothing of that science till upwards of twenty, and that, in fact, he taught himself mathematics, out of spite to an uncle of his who had offended him, by calling him a worthless fellow, or something of the kind, so Emerson determined to be revenged on him, and prove himself a better fellow than his worthy and reverend relative was, and so he did ultimately, as his numerous and excellent works amply testify—a noble revenge truly; an example worthy of imitation by all.

Simpson, the professor of mathematics at the Woolwich Military Academy, was a poor weaver's son, and taught himself mathematics whilst working at his trade, surrounded by poverty and distress of all kinds, yet this did not deter him, but, on the contrary, excited him to nobler exertions and industry.

To those who wish to become acquainted with the doctrine of fluxions, I know of no other work in which the subject is at once so easy and profoundly treated. But of all the mathematicians and philosophers whose industry and unwearied diligence surprise us, I think none can be matched with Leonhard Euler, professor of mathematics at Petersburg, who wrote himself blind, and even after that calamity wrote his well-known treatise on algebra, besides a multitude of other subjects in all branches of analytic science, so that even after his death his executors were able for a series of years to enrich the transactions of the societies of Europe with learned articles written by him, and collected from an immense mass of writings which he left behind him at his death. Indeed we could bring such a numerous list of names of eminent men who have raised themselves from indigence to the noblest places which a man can desire to fill, and raised for themselves by their talent, a name that will be known and revered whilst the love of learning prevails amongst mankind.

From an attentive examination of the progress and conduct of these men when labouring to improve themselves, and yet unknown and unregarded by the world, we shall invariably find the same degree of industry and energetic enthusiasm inherent in their heart, as when in later times, and in the zenith of their fame, we find them struggling for mastery with some cotemporary genius, or for the crown of their ambition, the triumphant reward and praise of some learned association or academy.

If necessary, I might illustrate my position still more, by bringing living evidence; we might refer to such men as Biot, Arago, and Brewster, Herschell and Whewell, who for a long series of years have continued to enrich nearly every branch of our literature, but more especially science. Over what a long series of years does the labours of Biot and Arago extend, from the beginning of this century up to the present day, and still we see them unflagging and unwearied, and still pursuing the same course of industry and investigation, as when panting and labouring for that fame which now they enjoy, and which, when their mortal remains have crumbled into dust, will remain for ever to testify the admiration in which such men are held, and to point out to the rising generation the great and glorious reward of their industry, but nobler still to excite the emulation and competition of those whom virtue had enriched with her noblest and most beneficent gifts.

EBORACUM.

DAGUERRE'S METHOD OF FIXING THE IMAGE OF THE CAMERA OBSCURA.

THE following description of one of the processes employed by M. Daguerre, and communicated by him to M. Biot, though not the one by which the surprising results described in previous numbers of "The Mechanic" were obtained, will nevertheless enable our readers to produce, with little trouble, a correct and permanent delineation of the image exhibited by the camera obscura. Take a piece of unsized paper (such as is used for printing), dip it in muriatic ether, and dry it in the air, or with a very gentle heat; it is essential that it be perfectly dry; then take a solution of nitrate of silver in distilled water (which should be kept in the dark), and dip into it the dried paper, previously impregnated with the muriatic ether. The paper must then be dried *in the dark*; and if it be desired to accelerate the dessication by heat, it must be very gentle; for when this preparation is damp, the calorific radiation, even from non luminous bodies, will act upon it in the same manner as light, in changing its colour. Paper so prepared should be kept between the leaves of a book, or otherwise screened from the light, if not intended for immediate use.

This paper being exposed to the solar light, or to diffused light, either direct, or transmitted through a transparent glass, becomes coloured with extreme promptitude, and exhibits very sensible tints, before the nitrate presents the least trace of alteration. The difference of rapidity is sustained throughout all the phases of colouration, by which the paper passes. The colours may be definitively fixed at any required period, and all ulterior progress arrested, by removing the nitrate which has not yet entered into combination. This is effected by washing the paper in a sufficient quantity of water; when it is completely dried (without heat) it is no longer impressionable by the action of light. If it is not desired to preserve this paper in a permanent state, so that the colours shall remain absolutely immutable, it is sufficient to keep it in a portfolio, from which the light is excluded, and only expose it to view by an artificial light, especially the first few days; for it loses its sensibility by degrees, and ultimately becomes excitable in a very small degree. M. Daguerre has remarked, that the efficiency of washing is not alike in all kinds of paper; but not finding in this preparation all the properties which were required for the end which he sought to attain, he discontinued his experiments.

The effect obtained by this process, must necessarily be an intensity of colour, where there is an intensity of light. Consequently, if employed to fix the image of the camera obscura, the light objects, the sky, for instance, would be represented in black, and dark objects, as trees, &c., would remain white. The process now employed by M. Daguerre, is exempt from this obstacle to the true representation of nature. Any liquid whatever applied to the paper, instead of muriatic ether, and before the nitrate of silver, determines a tint of a different nature, and more or less impressionable. Even the quality of the substance of which the paper is made, whether it be sized or not, determines also different shades; but in all cases the process of colouration may be arrested by immersion in water.

THE CHEMIST.

ON THE

CHEMICAL COMPOSITION OF THE FIBRES OF WOOD AND PLANTS.

The analysis of wood has, till recently, been generally confined to the examination of the various substances deposited in the pores between the organic fibres, such as resins, oils, salts, &c.; but the composition of the fibres themselves was unknown and rarely inquired into. The following are some of the most remarkable results of Mr. Payer's experiments:—

In order to attain the principal end of his researches, it was necessary to obtain the tissue of vegetables recently formed, so that its composition might be as little as possible marked by the divers substances which are afterwards secreted; it was also necessary to examine seperately the elementary tissue of the different parts of a plant, in order to establish the identity of the results obtained form all those parts. The gelatini form tissue of the unfecnndated ovula of almonds, *amygdalus communis*, was carefully extracted; 2nd, the ovula enclosed in the flowers of the *heliantus annuus;* 3rd, those from the flowers of the apricot, apple, and cherry. Another series of very young tissues was obtained from the extremities of the small fibrous roots of several ligneous and herbaceous plants. Membranes still nearer their first formation, were obtained from the scarcely coagulated excrescences of the cucumber. The pith of the green branches of elder and some others, were also submitted to the experiment. Each of these substances was immediately disengaged from the various matters which are common to them all, by treating them first with cold water, which extracted an azoted substance, and several salts and an acid; next by alcohol, which removed the traces of resinoid substances; and then by heat, with a solution containing one-tenth of its weight of pure soda, and, finally, with chlorhydric acid, in order to dissolve small quantities of calcareous salts. After the reaction of each of these solvents, the residue was washed in pure water, and dried *in vacuo* at a temperature of 150 to 180°. The analysis of this residue, operated by the ordinary means, gave for the different substances above named, numbers which differ only in the tenths. The following is the result of one analysis, the rice paper brought from China, which is made of pith:—

Carbon	43.4
Hydrogen	6.3
Oxygen	50.3

This result demonstrates, that the proper tissue of vegetables is a composition very different from what has been hitherto generally supposed. It is not the same substance as wood. Now its presence being constant, and its proportion varying considerably in different kinds of wood, it must be expected that the chemical composition of woods must vary. A new field for investigation was thus clearly indicated. In comparing the action of different bodies upon the pure elementary tissue, and upon the ligneous tissues, it was soon discovered, that the substance thickening the interior of the fibrous cellules, is attackable by agents, to which the former resists, especially soda and caustic potass.

With a view of determining the composition of woods with ligneous fibres unequally thick, it was necessary to avoid the use of those agents in sufficient proportions to take away sensible quantities of the ligneous fibres, and confine their action to the solution of azoted substances, insoluble in pure water.

Woods reduced to fine powder were successively washed in alcohol, pure cold water, with once their volume to 0.10 of soda, and, lastly, in water sharpened with 0.05 of chlorhydric acid, washing them in pure water between each operation, and finally drying them as before described. The two results which presented the greatest difference, are the following:— Beech washed in cold water, then in hot water, alcohol, and chlorhydric acid.

Carbon	54.35
Hydrogen	6.25
Oxygen	32.58

Herminiera (*bilor* of the negros of Senegal:—

Carbon	47.11
Hydrogen	5.94
Oxygen	46.88

From the comparison of these two analyses, as well as from all the other results obtained by M. Payen, it appears that the proportion of carbon relatively to the two other elements, and the predominance of the hydrogen over the oxygen, are so much more pronounced, as the woods are more ligneous, and reciprocally.

CURSORY REMARKS ON TOXICOLOGY.

NO. V.

English spiders, though reputed venemous, are quite inoffensive. Some are found in Africa and South America, with bodies as large as a hen's egg, and capable

of inflicting dangerous bites. The Tarantula spider is a native of Apulia, in Italy; its bite is said to make the person hop, skip, and jump about, in a most extravagant manner. Those who like to believe it, can; the writer does not.

The black ants of Africa are very formidable; they have been known to overwhelm with their numbers, destroy by their bites, and afterwards devour solitary travellers, in the wildernesses of that country. These depredators rove about, in incredible numbers, on predatory excursions; and the utmost order is observed in their movements.

The great West Indian locust has a diminutive, but dangerous sting; which causes violent shiverings. Oil is the remedy.

The sea nettle is a living creature, resembling a hollow and empty bladder; its colours are very beautiful. On a bright summer's evening, numbers are visible at sea; and if a man should fall overboard, they fasten on him; and their bodies burst, covering him with dreadful blisters produced by the poisonous matter, contained in the insides of these skimmers of the sea. Some captains state, that should any of these nettles sting the arm of a seaman, which may occur, without his falling overboard, it should be instantly rubbed with cold oil; as delay, in this case, is invariably the cause of the amputation of the limb. The above is extracted from a periodical publication, now extinct.

The following circumstances occurred at a parish in Wiltshire, in December, 1822. A quantity of beef soup was prepared, and distributed to the poor of the parish, which was boiled in a large copper boiler; and, either from the poisonous nature of the copper, or its not being properly cleansed, all who partook of it, were, about midnight, violently attacked in the stomach and intestines. Nearly the whole parish were complaining, children crying, and the people running, naked, about the streets and gardens; which created a degree of confusion, more easily imagined than described. Many of the labourers could not work next day; but, fortunately, no instance of severe illness followed.

A somewhat similar case occurred, some few years ago, in Germany. An entertainment was given in celebration of a marriage; part of the provisions were dressed in a copper which had not been used for some time; and, in the hurry and bustle of the occasion, it was forgotten to be properly cleansed from the verdigris which was supposed to have existed in it. The consequences were fatal; a number of the guests were taken dangerously ill; and if the writer's memory serves him, several died. It is to be observed, that the green rust which we often see on copper, &c., is *not* verdigris, but a carbonate of copper, formed by the moisture of the air *oxidizing* the copper; which then unites with carbonic acid from the atmosphere. (An oxide is that substance, into which metals are changed, by a combination with *oxygen gas*. The atmosphere we breathe, is composed of oxygen, nitrogen, and carbonic acid gases.) Verdigris is a salt formed by the union of acetic acid (the acid contained in vinegar), with copper.

During February, 1822, several respectable individuals resident in the neighbourhood of Brighton, lost their lives, through the mischievous practice which was then in vogue, of wearing sheet copper in the soles of the shoes, to keep the feet warm and dry. It often happens, that the inner sole gives way; in which case, the perspiration of the feet acts upon the upper, and communicates to the system an active, and dangerous poison.

Instances have been known, of persons dropping down dead, through applying their mouths to the bung-hole of a cask, containing beer in a state of fermentation. The reason is, that fermentation generates great quantities of carbonic acid gas, or fixed air; which, when breathed in a pure state, instantly extinguishes vitality in animals. This when taken into the stomach, as it is in beer, &c., is quite the opposite to injurious.

Concerning casualties in mines, wells, &c., from bad air, enough is known. Common prudence is, in general, all that is necessary to prevent the occurrence of these accidents.

The modes in which arsenic produces its fatal effects, differ: sometimes, the mortified state of the stomach after death, would lead to suppose that it was caused by the local action on that organ; whilst at other times, the stomach has been found to have suffered scarcely anything at all; which would demonstrate, that it must have been absorbed, and circulated through the system. Mr. Brodie's inquiries into this subject do him infinite credit. England boasts of the researches of her medical profession, and she has cause so to do.

VANDERKISTE, JUNR.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Tower Street Mutual Instruction Society.—Monday, March 11, Mr. Bowkett, on Philosophy of Health. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, March 12, Mr. Burton, on Chemistry and Machinery. At half-past Eight.

Poplar Institution, East India Road. — Tuesday, March 12, Mr. Gascoigne, on Shakspeare.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 14, John Christopher Bowles, Esq., on Lithography. At half-past Eight.

Society for Promoting Practical Design, Saville House, Leicester Square, Monday, March 11, Geo. Foggo, Esq., on Instruction in the Arts. At a quarter past eight precisely.

London Temperance Institute, 167, Fleet Street.—Friday, March 8, Mr. J. F. Vicary, on Phrenology. At Eight.

Greenwich Society, 15, Nelson Street, Greenwich.—Tuesday, March 5, Mr. Seare, on the Writings of Charles Dickens. At eight precisely.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—Can any of your Correspondents inform me if a gas stove is more expensive in its consumption than a stove (to give out the same heat) in which coal or coke is burned ?

Sir,—In a former Number of your useful work, I requested to be informed the best method of making platina balls. A Subscriber.

Sir,—I shall feel particularly obliged by an early answer from you or any of your correspondents, to the following questions :—

The simplest method of gilding the leaves of books, so that they will not stick when done.—The method adopted in gilding the backs of fancy cloth books ; what is used to make the gold adhere without soiling, like the Pictorial Bible, &c. ?—What composition is used for cloth covers, to give them that shining quality when finished ?—The composition used, instead of glaire, or white of egg, for leathers ? I have tried several methods from books and the Penny Mechanic, but do not succeed to my satisfaction.

S.

Sir,—I should feel obliged if you or any of your numerous Correspondents can inform me, how the marble paper, with which the Adelaide Gallery is hung, is manufactured, a specimen of which I enclose ? H. Dyoll.

Sir,—In Vol. III, No. 110, you have given a receipt for sealing-wax, and to pour the composition in what is called sticks; will you or any of your numerous correspondents be so obliging as to inform me where I can purchase the sticks, and what they are made of ? I want to mould the same as sold in the shops ?

J. W.

Sir,—Your 14th No., published Feb. 21, 1837, contains an extract from a publication by Dr. Babbage, in which it is stated, that worn-out coal-scuttles, &c., are, in combination with pyrolignous acid, converted into a black dye for the use of calico printing; if you could inform me where such dye may be purchased, I shall feel much obliged. Thos. Douglass.

Sir,—Will you have the goodness, through the medium of your useful publication (which furnished a receipt for blue ink, composed of prussiate of potash, copperas, and gum), to inform me the cause of the liquid becoming green instead of bright blue ; it has been exposed to the light and air, and has been mixed for the space of five weeks, and whether a quicker process could not be procured ?

A. Kensett.

Sir,—Please to allow me to ask through your pages the following queries :—Can I, and by what means, ascertain what distance a wheel of eleven feet in circumference has travelled in the course of a journey, supposing no mile stones were in the roads I travelled. Also, where I can learn book-keeping, by double entry, at an easy cost ?

A Constant Reader.

ANSWERS TO QUERIES.

Sir,—Your Correspondent can see a velocipede and ascertain the expense of making one on Mr. Landen's principle, by giving his address in your pages.

A Constant Reader.

To remove Varnish from Oil Paintings.—" An Amateur is advised to use turpentine to be applied with a soft linen rag : this must be repeated several times ; finish with spirits of wine. Great care is necessary in using the spirits of wine, to avoid injury to the colours. Renovator.

Sir,—I beg to inform " H. H." that he can obtain glass cylinders for an electrical machine, at Palmer's, 103, Newgate-street, from 3s. 6d. each.

R. S. L.

TO CORRESPONDENTS.

If S., of Berkhampstead, *had paid the postage of his letter, his queries would have been inserted. We have repeatedly stated, that no letters are taken in, unless post paid. In the present case, however, as the letter is marked by our Correspondent as " paid," we are disposed to think he has placed it in the hands of some one who has* thought *of the letter, but* forgotten *the postage.*

J. L—ffe.—*Hydrogen gas may be produced by immersing zinc, or iron filings, in diluted sulphuric acid ; it may be collected in a bladder attached to the neck of the bottle, which contains the acid, &c. Several methods of producing oxygen gas were described in a recent number of this work. His other query shall be attended to.*

Gamma. *We concur with our Correspondent, in deprecating the worse than waste of leisure hours, which are too often dissipated in pursuits alike injurious to health, mind, and purse. We also agree with him when he points out the importance of making a judicious choice of books ; for there are wholesome and unwholesome aliments for the mind, as well as for the body. The publications which he recommends, are, we doubt not, worthy of his commendation ; but we never publish anything in the shape of a review, except upon our own judgment and responsibility.*

F. James *describes a method of preventing the accidental explosion of oxygen and hydrogen gas, by inserting a piece of sponge near the orifice from which the dangerous mixture is emitted : this plan, though published (we believe) many years ago, has not attracted the notice which it appears to deserve. Perhaps very fine metallic cloth would be preferable, applied as described in a former number of this work, on a large scale for preventing fire in chimnies.*

J. H.—*Many schemes have at different times been advertised for rendering cloth water-proof, but they have not proved successful. There is now a company called " The British Water-proofing Company," professing to make woollen cloth impervious to wet, but allowing free passage to the perspiration ; or, in other words, it is, and it is not, impenetrable.*

London: Printed at " The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney; and published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

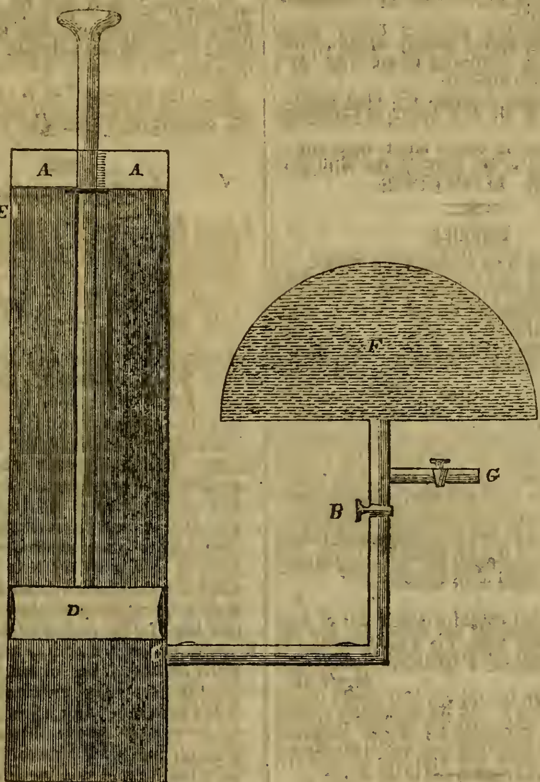
THE

MECHANIC AND CHEMIST.

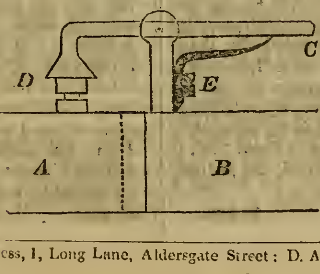
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XII. NEW SERIES. | SATURDAY, MARCH 16, 1839. (PRICE ONE PENNY.) | No. CXXXIII. OLD SERIES.

RITCHIE'S AIR-PUMP.



PERCUSSION-LOCK.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

RITCHIE'S AIR PUMP.

To the Editor of the Mechanic and Chemist.

(See Fig. 1, *front page.)*

Sir,—In No. 47 of your most estimable miscellany, there is a description of an air pump, which I think is very defective; and as one of your correspondents has inquired concerning the stop-cock of the same, and it not having been answered, I take the liberty of sending you a description of one, which I have copied from "Hebert's Encyclopedia." It is the invention of a Mr. W. Ritchie. The machine consists of a barrel, shut at the lower end; it can be made of a piece of 1½-inch diameter brass tubing, about seven inches long, and having a small aperture at c, forming a free communication with the receiver at f; the piston, d, is like the sucker of a syringe, and stuffed with oakum; the piston rod works in a small stuffing box at a, so as to render it completely air-tight. There is a small aperture at e, in the top of the barrel, to allow the air to escape when the piston is raised. This air pump may be worked in the usual way, or by the method of continual motion. In commencing the exhaustion of the receiver, the piston is supposed to be below the small aperture at c. The piston is then raised, and the air which occupied the barrel is forced out through the aperture at e. The end of one of the fingers is applied to the aperture in the same manner as in playing a German flute; the air easily passes by the finger, which, when the piston begins to descend, shuts the opening, and completely prevents the entrance of the external air. The piston being again forced down below the opening, c, the air in the receiver rushes into the barrel, and is again expelled by the ascending piston; at b is a stop-cock, to close the tube when all the air is drawn out; at g is a tube, and stop-cock, to let the air into the receiver.

I remain, your's, &c.,

A. P.

PERCUSSION LOCK.

(See Fig. 2, *front page.)*

A, gun (or pistol) barrel; b, gun stock; c, cock, which, being pressed by the thumb, and the latter suddenly slipped off, falls on the cap at d, and fires the piece; e, a strong spring. On a gun, or large pistol, the lock should, as usual, be at the side, to allow of aim being taken. The cut represents a pocket pistol, furnished with such a lock.

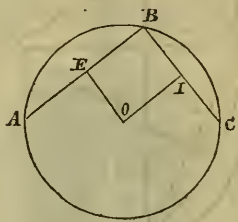
T. R. Gillies.

TO FIND THE CENTRE OF SEMICIRCULAR AND SEGMENTAL ARCHES.

To the Editor of the Mechanic and Chemist.

Sir,—I have seen a great many directions given in your work, for the purpose of describing arches, and perhaps the following may be found useful enough to be inserted amongst the rest; but, first of all, I shall give a well-known question, though not the less useful, namely, that of drawing a circle through the three given points; for instance, to draw a circle through the three points, a b c of fig. 1;

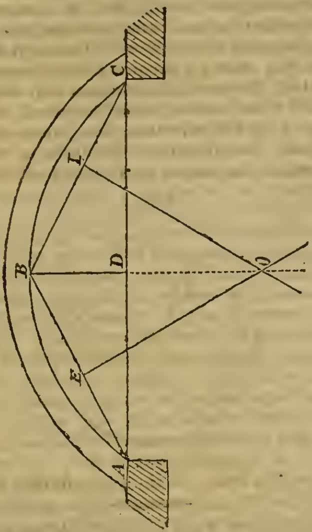
Fig. 1.



to do this, first join the two points, a b, by the line a b, and similarly join b c by the line b c, then halve both the lines a b and b c in the points e and i, and at these points of bisection, draw the two lines e o, i t, perpendicular so a b c c, and where these lines intersect each other, will be the centre of the circle required; then with the centre, o, and the distance of any one of the points a b c, describe a circle, and the thing is done. This is a very useful problem to the builder and engineer; for instance, let us suppose that a builder has a drawing of the centreing of a bridge or the intrados of an arch, and he wishes to find the centre of the circle belonging to that arch, he may evidently find it as above, by taking any three points in the arc, and drawing the lines as directed above, he can by this means find the centre required, and this method is quite general; but the most useful application of it is in the solution of the following practical questions:—Suppose we have given the span of a circular segmental arch from the springings or haunches, and also the versine, or rise, of the crown of the arch, to find the centre of the circle corresponding to the lines which we have given. First draw the span of your arch, and in the middle erect a line equal to the given rise, and these two lines are all the data that are given, and, in fact, all that are required. Suppose (fig. 2) that

A C and B D are the lines so drawn, join A B and B C, the same as directed in the first question, then bisect the the two hypothenusal lines, A B B C, in the points E

Fig. 2.



and I, and from these two points draw the perpendiculars, E O and I O, and O will be the centre of the required arch, A B C, and may be drawn as already directed. In the figure I have drawn two arcs, the inner one corresponding to the given lines, and the outer by merely increasing the radius O B; these lines may be supposed the etrados and intrados of the arch. And if it be necessary, we can easily compute the length of the chords, A B, B C, which in some cases may be required, and from this we may find the points E and I by direct computation; this may be done by the well known 47th of Euclid. In the triangles, A B D, D B C, are right triangled, therefore we have $(AD^2+DB^2)=AB^2$, and the same for the other triangle, and therefore the chord, A B will be equal to $\sqrt{(AD^2+DB^2)}$, and thence we have A E or $EB=\frac{AB}{2}=\frac{\sqrt{(AD^2+DB^2)}}{2}$, so that substituting the known heights and span of the bridge in the above formulas, we shall obtain the quantities required. This problem is plainly a useful one, as already mentioned, both to builders, engineers, and architects, and as circular arcs are much used in small or common buildings, it will be frequently necessary to employ it; for instance, in making the centreing for the cellars of houses, and similar purposes.

I remain yours, &c.

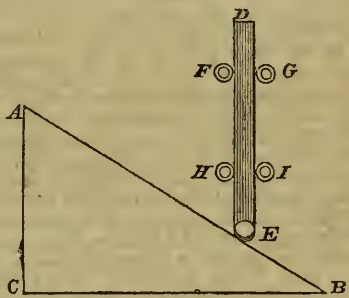
EBORACUM.

ON THE MECHANICAL POWERS.

NO. VIII.

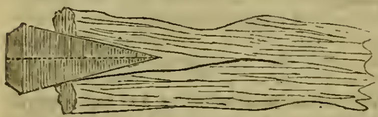
In the application of the inclined plane hitherto noticed, the machine itself is supposed to be fixed in its position, while the weight, or load, is moved upon it. But it frequently happens, that resistances are to be overcome which do not admit to be thus moved. In such cases, instead of moving the load upon the planes, the plane is to be moved under, or against the load. Let D E, fig. 1, be a heavy

Fig. 1.



beam, secured in a vertical position between guides, F G and H I, so that it is free to move upwards and downwards, but not laterally. Let A B C be an inclined plane, the end of which is placed beneath the end of the beam; a force applied to the back of this plane, A C, in the direction C B, will urge the plane under the beam, so as to raise the beam in the direction A. Thus, while the inclined plane is moved through the distance, C B, the beam is raised through the height C A. When the inclined plane is applied in this manner, it is called *a wedge*; and if the power applied to the back were a continued pressure, its proportion to the weight would be that of A C to C B. It follows, therefore, that the more acute the angle B is, the more powerful will be the wedge. In some cases, the wedge is formed of two inclined planes, placed base to base, as in fig. 2. The theoretical estimation of the power of this machine is not applicable in practice with any degree of accuracy. This is in part

owing to the enormous proportion which the friction in most cases bears to the theoretical value of the power, but still



more to the nature of the power generally used. The force of a blow is of a nature so wholly different from continued forces, such as the pressure of weights, or the resistance offered by the cohesion of bodies, that they admit of no numerical comparison. Hence we cannot properly state the proportion which the force of a blow bears to the amount of a weight or resistance. The wedge is almost invariably urged by percussion, while the resistance which it has to overcome are as constantly forces of the other kind. Although no exact numerical comparison can be made, yet it may be stated in a general way, that the wedge is more powerful as its angle is more acute. Wedges are used where enormous force is to be exerted through a very small space. Ships are raised in docks by wedges driven under their keels. The wedge is the principal agent in the mill. The seeds from which the oil is to be extracted are introduced into hair-bags, and placed between planes of hard wood; wedges inserted between the bags are driven, by allowing heavy beams to fall upon them. The pressure thus exerted is so intense, that the seeds in the bags are formed into a mass nearly as solid as wood. Instances have occurred, in which the wedge has been used to restore a tottering edifice to its perpendicular position. All cutting and piercing instruments, such as knives, scissors, chisels, nails, awls, &c., are wedges. The angle of the wedge, in these cases, is more or less acute according to the purpose to which it is to be applied. In determining this, two things are to be considered,—the mechanical power, which is increased by diminishing the angle of the wedge and the strength of the tool, which is always diminished by the same cause. There is, therefore, a limit to the increase of the power, and that degree of sharpness only is to be given which is consistent with the strength requisite for the purpose to which it is to be applied. In logs intended for cutting wood, the angle is about 30°; for iron, it is from 50° to 60°; and for brass, from 80° to 90°. Tools which act by pressure, may be made more acute than those which are driven by a blow: and, in general, the softer and more yielding the substance to be divided is, and the less the power required to act upon it, the more acute the wedge may be constructed. In many cases the utility of the wedge depends on that which is entirely omitted in its theory, viz., the friction, which arises between its surface and the substance which it divides. This is the case when pins or nails are used for binding the parts or structures together, in which case, were it not for the friction, they would recoil from their places, and fail to produce the desired effect. Even when the wedge is used as a mechanical engine, the presence of friction is indispensable to its practical utility. The power, as before stated, generally acts by successive blows, and is thereby subject to constant intermission; and but for the friction, the wedge would recoil between the intervals of the blows with as much force as it had been driven forward. The friction in this case is of the same use as a ratchet wheel, but is more necessary, as the power applied to the wedge is more liable to intermission than in the cases where ratchet wheels are generally used.

I am, Sir, yours, &c.

A. D. M.

COMMON ROAD LOCOMOTION.

To the Editor of the Mechanic and Chemist.

If one thing more than another has characterised the people of the present age, it is that they have taken too much for granted concerning any popular scheme, without first inquiring into its merits or defects. And I think, on consideration of the matter, that all must allow, that exactly the same has happened as regards common-road locomotion; for while some eight years ago, when the project was in its comparative infancy, one part of the public took it for granted, that twenty miles an hour, or more, would be attained by steam coaches; the other part as gravely asserted, that they would not move at all; the consequence was, that when the experiment was tested, both were disappointed, and the one would not support the system, because of a foolish enmity they had against it on mere secular grounds, and the other wonder-seeking part would have nothing to do with it, because their extravagant anticipations were not realised in the very onset of the undertaking; combined with which, the railway mania, which was then prevailing in this country, tended greatly to bring this mode of travelling into disrepute. But though at that time the locomoteurs

found not many admirers of their views, yet there were a few knowing ones in the field who unhesitatingly predicted the approach of a period when they should perceive the consummation of their endeavours in the utility of their invention. That period is now fast approaching, and a few difficulties only remain to be overcome before its arrival, and these are, a proper supply of coke and water, and the state of the roads. The first is an evil easy to be overcome, as at all the towns where gas is used, coke might quickly be obtained, and in those towns and villages where it cannot be now got, the manufacture of it for locomotive purposes would not be an unprofitable occupation.

A proposition has lately been made to apply to government for leave to lay down a double line of trams by the sides of the turnpike-roads, the expense is estimated at 1350*l.* per mile; thus the expense of a double line from London to Birmingham would be 416,000*l.*, a trifle, when compared with the railway; and if carried into operation would, I have no doubt, well repay the shareholders, and soon bring the "rail" to a discount. A portion of the road in this neighbourhood has been so laid, and has fully justified the anticipations of the projectors. Twelve and fourteen miles per hour is the pace now common on that part of the road.

I remain yours, &c.

St. Albans. T. S. Browne.

HINTS TO MECHANICS.

I have hinted, in my own memoir, at the waste which arises among multitudes of mechanics through ignorance, from their engaging *in foolish and fruitless speculations and pursuits.* This consideration is very serious. If half the time which has been devoted to *perpetual motion*, had been devoted to study and experiments such as a very little true science would have suggested, we do not know how many more Watts and Franklins would have appeared; but we are certain that a vast amount of time, money, and disappointment might have been saved. I mention this as an example. Our daily experience has led us all to many others. The world seems hardly to grow any wiser in this respect from age to age. Every generation heretofore has had its hobbies—its ways of wasting time and mind. It might be astrology—or the transmutation of the baser metals into gold—to effect which purpose the greater part of the natural science of the middle ages was directed, though no more practicable than to transmute them into fish; or it might be the *divining-rod*, or the "elixir of life;" or, in a word, any other impossible and stupid thing. No matter; it was only the *perpetual motion* of these particular periods and men. The same stupidity, the same wretched waste, continue still in other shapes. The most glaringly ridiculous schemes are too generally notorious to do much harm; but their place is always, as they are shoved off the stage by public opinion, filled up by whole regiments of raw recruits. Let the mechanic beware of these decoys. Time is money—mind is money: both are too good to be wasted. Again, I say, he must know what he should be about, and how to be about it. If he has any leisure, let him spend it *in* the right way.

Much the same might be said of a thousand varieties of superstitions and impositions of every conceivable kind, to which the ignorant of all classes, and not least of our class, are constantly exposed. This may not be altogether in the way of business; but the effects on business, and on the prosperity and thrift of a mechanic, as well as on his respectability, (which is indeed a part of his thrift,) can hardly be too strongly described. Let it pass, however, with this hint. I will only add Mr. Simpson's account of the matter, as relates to the working men at large. After saying that one of them seldom knows enough to better his condition in life he adds as follows:—

"On the contrary, he is the creature of impulses, the unresisting slave of sensual appetites, the ready dupe of the quack,* the thrall of the fanatic, and, above all, the passive instrument of the political agitator, whose sinister views and falsehoods he is unable to detect, and who, by flattering his passions and prejudices, has power to sway him, like an overgrown child, to his purposes of injustice, violence, and destruction. He is told in the harangue from the waggon, and he believes the demagogue's hypocritical slang, that his class, because the most numerous, are the most enlightened, and generous, and noble; that they ought to make the

* "The cost of advertising quack medicines in the twenty-four States, annually, is supposed to amount to two hundred thousand dollars. A peck of pills a day is considered necessary for Boston, and half a bushel for New York. On an average, only one in twenty-five who take them is actually sick; and the proportion of those who dispense with some necessary of life to purchase nostrums which do them a positive injury, is in the ratio of eighty-seven to every hundred throughout the country."—*American Medical Journal.*

laws, and rule the state; nay, that their will ought to be the law, as their judgment is absolute wisdom. The poor man who believes this will believe anything, and will act on this belief as a ready instrument of violence. Witness the peril of the merely accused, but yet untried and unconvicted, who chance to fall into his hands, and a single hint in the street will raise the mob against an innocent person; witness, too, the eager destruction of machinery and property, and the mad burning of food. Can we forget, moreover, the fury and violence with which benevolently offered medical aid in the cholera was repelled under the impression that 'the doctors' *induced* the disease, to obtain subjects for dissection, and went the length of poisoning the water!"

I do not say this description applies to all mechanics; but I believe most of them may get valuable *hints* from it. Mr. Simpson alludes more particularly to combinations and strikes for larger wages and shorter hours:—

"Both of which," he thinks,—mark this—"misapplied, as, in his present condition, intellectual and moral, they would be, to the purposes of idleness and sensuality, would only render his condition worse; and too often he is not slow to aid the physical force of such short-sighted unions, in intimidating and even assaulting, and, it has happened, maiming,—nay murdering,—other labourers, who prefer giving their work to any employer, and at any value they think fit, to joining in the 'strike.' By this attempt to force a larger share of capital than without force would come to them, the workman succeeds in nothing but driving it away from the place, or out of the country, and by his own acts puts even the wages he quarrelled with out of his reach. Education alone will make it clear to him, that it is in vain for the labourers to expect, in a market where their numbers exceed the demand, to succeed ultimately in the objects of a strike. *Strike* they must, in another sense, in the conflict, and then they will find that they have reduced the amount of the capital which alone can employ and maintain them, and that fewer hands can be engaged at the same wages, or else lower wages than those that induced the stop must be taken by the same number."

Not fit, then, for larger wages, or shorter hours. This is a hard case indeed. We want leisure and funds to improve ourselves; but we are told we must improve ourselves first, else they cannot trust us to use our money and spare hours as we ought. This is hard, I say. But how are we going to help it? With the mechanics, the answer is easy enough. We may do what can be done by *all* fair means gradually to get more leisure and better wages; but depend on it the best and surest policy meanwhile, and at any rate, *is to use what we have to the best advantage*. Too much of what Mr. Simpson says is *true*, and it ought not to be so; it might be otherwise if we did what we could. If the fund of cash and time which have been worse than wasted in *strikes*, and in consequence of them in our country, within a few years, had been carefully devoted by the same men to their own improvement, instead of their own ruin, how vastly different would have been the result. The more intelligent mechanics become, the less they will get into these foolish scrapes, I am sure, and every other mess of the sort. They will see, first of all, that what Mr. Simpson says against short hours and better wages, shall not apply any longer, or in any degree, if it now does, to *them*; and they will *then* take, in the very process of self-improvement, the surest possible course for procuring that justice to be done to them which it shall appear so clearly they both understand and deserve. It has been stated of late that not more than two members among some twelve hundred (I think) of the Mechanics' Institute at Liverpool have ever been concerned in trades' unions!—*Claxton's Hints to Mechanics.*

Steam-boiler Inspectors. — Government has appointed two gentlemen, Captain Pringle, R.E. and Mr. Josiah Parkes, civil engineer, to inquire into, and report upon, the nature, causes, and practicable methods for the prevention of accidents to life and property, arising from explosions of boilers, defective machinery, &c., in steam-vessels.—*Perth Courier.*

To Melt Metals in a Nut-shell without Burning it.—Take saltpetre, two ounces; sulphur, half an ounce; dry sawdust, half an ounce; these must be finely powdered and well mixed together; fill the shell of a nut with it to the brim, then lay a piece of what metal you please on the top, and having covered it over with the powder, set fire to it, and you will see that the metal will melt and remain at the bottom of the shell.

To take Rust from Iron immediately.—Rub it with a rag dipped in oil of tartar.

To increase the virtue of Loadstone.—You must let it soak forty days in iron oil.

THE CHEMIST.

NEW DISCOVERIES AND EXPERIMENTS.

Temperature of the Sea and Air between the Tropics.—According to M. Pentland, the average temperature between the equator, and the tenth parallel on each side, approaches very near to the 26° 6' centigrade. The maximum for the water is 28° 1'; and for the air, 28° 4'.

Navigation by Steam and Sailing Combined.—M. Béchamiel, captain of the *Véloce*, has addressed to M. Arago, the details of a voyage which he has just made from Rochfort to Havanna. The distance, which is 1850 miles, was performed in less than 29 days; which gives 64 marine leagues, or about 220 English miles, a day. He consumed 290 tons of coal; using the engines only when the wind was contrary. He calculates that *the Great Western* would have taken 31 days to perform the same, and with a consumption of 900 tons of coal. This experiment resolves the problem of employing steam vessels for long voyages. The system of M. Béchamiel is so combined, that the masts may be put up, or taken down, according as it is required to employ steam or sails. Thus the use of the steam apparatus is reserved for calm or contrary wind.

Height of Barometer between the Tropics.—M. Pentland has endeavoured to ascertain the average height of the barometer between the tropics. His observations, which are very exact, coincide with the results obtained by M. Boussingault; he makes the average height of the mercury 0 76983. The French metre is equal to 3·2808992 English feet.

Measurement of Halos.—M. Pentland has also communicated to M. Arago, the result of several observations upon halos, which he has had an opportunity of measuring; he has found them from 43 to 46 degrees; most frequently the elliptical appearance which they present is imperfect; but M. Arago has observed one which was perfectly elliptical, and he explains this phenomenon by the difference of temperature of the prisms of ice in the superior regions, and in the vicinity of the earth.

Generation of Eels. — M. Joannis has sent a notice upon this subject to the French Academy; he states, that an eel was caught in the month of March, and put into a large deep plate; in the evening it was found surrounded by upwards of 200 small eels, from an inch and a half to two inches in length. One of them was only half out.

Magic Picture.—Have a large print of the Queen with a frame and glass; cut a pannel out of the picture all roand, about two inches from the frame; with gum fasten the border that is cut off on the inside of the glass, pressing it smooth; then fill up the middle by covering it with tinfoil; cover likewise the inner edge of the bottom part of the back of the frame, then make a communication between that and the tinfoil in the middle, then put on the board, and that sideis finished. Turn it over, and cover the foreside with tinfoil, and when it is dry, paste over it the pannel of the print that was cut out, so that the picture will appear as it did at first, only part will be behind the glass and part in front; then place a small gilt crown on the queen's head, so that it is moveable; now if the tinfoil be electrified, and a person hold the bottom of the frame, so that his fingers touch the tinfoil, and with his other hand endeavour to take the crown off, he will receive a very smart blow, and fail in the attempt. The operator who holds the top of the frame where there is no tinfoil, feels nothing of the shock, and can touch the queen's face without danger, which he pretends is a test for his loyalty.

G——Y.

Bezoars.—Concretions found in the stomachs of animals, and formerly supposed to have great medical virtues. They are of several kinds, and some which the king of Prussia sent to Buonaparte, were found to be woody fibres agglutinated.

Death from Poisonous Vapour.—On Sunday two young men, named George Harfield and Charles Saunders, under gardeners in the service of Lord Bolton, were found dead in their bed-room adjoining the Conservatory, in the Spring-woods, at Hackwood-park. Both had been seen about six o'clock the previous evening, engaged as usual, but not making their appearance the next morning, and the door remaining fastened, suspicion was excited, and on breaking open the door about three o'clock in the afternoon, both the unfortunate men were found on the floor quite dead, Saunders partly dressed, and lying across his companion. The bed-room is not more than seven feet square, and communicates with the furnace-room, so as to permit of the noxious gas arising from the wood fires in the latter escaping into the former, from which, when the door and window are closed, it has no vent, and there is no doubt but the death of both was occasioned by inhaling a quantity of this poisonous vapour. The jury returned a verdict of "Accidental Death."—*Reading Mercury.*

ERRICSSON'S STEAM-BOAT PROPELLER.

The experimental iron steam-boat, Robert F. Stockton, constructed for testing Captain Erricsson's propeller, being on the eve of departure for the United States, the proprietor, at the request of a number ef scientific gentlemen, consented to another trial being made. The distance from the West India South-dock to a point opposite Woolwich Church and back, measuring 37,000 feet, was passed in 45 minutes (21 minutes with, and 24 against the tide), the boat towing a heavy city barge on the one side, a large wherry on the other, and another wherry astern. The speed of the engine was found to average 66 revolutions per minute. The success of this important improvement in steam navigation appeared quite conclusive.—*Times.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Tower Street Mutual Instruction Society.—Monday March 18. Mr. A. Morton, on Architecture. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, March 19, C. Reed, Esq., on Architecture. At half-past Eight.

Poplar Institution, East India Road. — Tuesday, March 19, Mr. Johnson, on Botany.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 21, Charles Johnson, Esq., on the Grasses. At half-past Eight.

Society for Promoting Practical Design, Saville House, Leicester Square, Monday, March 18, Edward Cowper, Esq., on Calico Printing. At a quarter past eight precisely.

London Temperance Institute, 167, Fleet Street.—Friday, March 15, Mons. Bott, on the Art of Teaching the French Language. At Eight.

Greenwich Society, 15, Nelson Street, Greenwich.—Tuesday, March 19, Mr. Elliott, on Physical Education. At eight precisely.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—I shall feel obliged if "W. E." will inform me if the wire is to pass through the small wheel in his machine for covering wire. R. S. L.

Sir,—I should feel much obliged if you or any of your correspondents could inform me the best method of blowing or casting gum into different shapes.
A Constant Reader.

Sir,—Will any of your scientific correspondents inform me of the best mode of separating the spelter from old metal or pewter? I find a difficulty in doing it. C. Launder.

Sir,—Can you or any of your correspondents inform me how to make a composition to clean plated, German silver, brass, and pewter goods, which are exposed to the weather, and will cause them to retain their colour? An Inquirer.

Sir,—I shall feel obliged through your publcation if I could be informed the particulars of making the storm glass which is sold at the opticians', having failed with Gray's receipt,—camphor two drachms, saltpetre one and a-half drachm, sal ammoniac half drachm, rectified spirits of wine two ounces, covered with a bladder. Thermonietum.

ANSWER TO QUERY.

To remove Varnish from Oil Paintings.—Sir,—I beg to inform "An Amateur" in No. 127, that he may remove the varnish from an oil painting by the following process:—About three proportion of tupentine to one of spirits of wine; to which add, supposing the mixture to be about half-a-pint, a full tea-spoonfull of nut oil, to be used as follows:—Place a piece of cotton wool at the mouth of the bottle,—about half the size of your hand, well pressed together,—and shake the mixture up to it, and not pour it on, then gently rub it on a small part of the painting, and immediately you perceive the necessary stir of the varnish, have ready another piece of wool well steeped in nut oil which will immediately stop the progress of any mischievous effect. Another stronger remedy used in the same manner is four proportions of turpentine to one of sal voatile.
J. Langford.

TO CORRESPONDENTS.

Gamma.—*We are happy to say, that his fears respecting the engineer of the Great Western Railway, are unfounded; the accident to which he alludes (if it may be so termed) was entirely the fault of the unfortunate sufferer. A party of women were going to their work in the fields, near Langley Marsh, and seeing the twelve o'clock train approaching from London, they waited on the bank, all but one unfortunate woman, who in spite of the calls of her companions, proceeded across the line. She was struck by the engine, and killed on the spot. A melancholy event certainly; but it does not appear that any blame is attached to the engineer, or any other person connected with the administration of the railway establishment. If a person were suddenly to place himself before a stage coach, or any other heavy carriage proceeding at a rapid pace, he would most likely lose his life. It is, however, worthy of consideration, whether it would not be adviseable to require all railway companies to make their roads inaccessible to persons and cattle, except at the proper stations; communication between the two sides might easily be effected by tunnels. This, of course, can only be accomplished by the interference of the legislature. In compliance with our correspondent's request, we have to state that a portion of his last inserted communication (relating to the torpedo, &c.) was extracted from the "Weekly Magazine."*

Luna.—*The distance between the telegraphic stations is usually six or eight miles; but it depends upon the convenience of the positions. Intelligence may be conveyed a hundred miles in two minutes, and the meaning of the signs is unknown even to the persons who work the machine. It is necessary to alter the signs from time to time, otherwise a person by frequent observation might interpret them. They do not merely express single letters, but syllables, words, and even sentences.*

J. S. *The French foot is a little longer than the English, being* 1·066 *in terms of English measure. There are about fifty feet of different countries, some greater, but most of them less than the English foot.*

All communications to be addressed to "The Editor of the Mechanic and Chemist, City Press, No. 1, Long-lane, Aldersgate."

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THE

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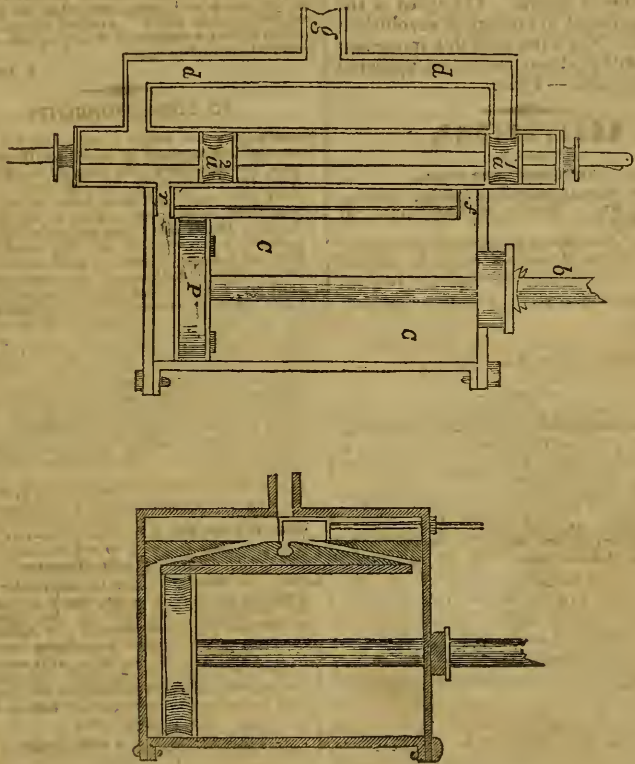

THE STEAM-ENGINE PISTON.

City Press, 1, Long Lane, Aldersgate Street; D. A. Doudney.

ON THE PISTON.

To the Editor of the Mechanic and Chemist.

(See front page.)

THE following explanations of two simple methods of letting the steam above and below the piston, will, no doubt, be interesting to "A. B.," and many of your readers:—

C C is the cylinder; P, the piston; B, the valve-box, in which move the two small pistons A¹ A², which are worked from the eccentric. The steam from the boiler enters the pipe *d d* at *g*, and passing under the piston a^2, it enters the cylinder at *r*, and forces the piston towards the top, during which time the steam contained above the piston has made its escape through *f*, under the piston a^1, to the exit pipe *o*, where it passes into the atmosphere, &c.; immediately on the piston having arrived at the top of the stroke, the pistons *a a* descend below *f* and *r*, and the steam being unable to penetrate through *a*1, it rushes above the piston a^1, and enters the cylinder at *f*, and forcing it downwards, the steam that was below it, passes through *r*, and into the exit-pipe *o*, and so on continually. The second method, which is much used in locomotives, will easily be understood, by reference to the diagram.

T. S. BROWNE.

4, College-street, St. Albans.

STEAM CARRIAGES ON COMMON ROADS.

To the Editor of the Mechanic and Chemist.

SIR,—Will you allow me to ask your Correspondent "Q." whether he has ever had occular demonstration of those facts to which I have recurred in my former letters on the subject, and if not, I would advise him, ere he again call me more "zealous than prudent," to read the Report of the Committee, who in 1832 were appointed by government to inquire into the practicability attendant on the application of steam-carriages to common roads, as he will at once find ample proof of the accuracy of my statements. And now, Sir, I am about to reconcile these indisputable facts with my notions of turning corners, and having a train of half a dozen carriages propelled by steam on the turnpike-roads, and propose, as I hinted in my last, that a double line of trams be laid on the centre of the carriage-way, leaving the sides of the road open to the accommodation of every other species of traffic. The advantages that would accrue from having the trains in the centre, and not on the sides of the road, are numerous; first, that they would in no way incommode the delivery of goods or the stoppage of vehicles at the various houses on the line; second, that carriages on the branch and cross roads would not, in many cases, have to pass over them to gain the main road; third, that in towns, &c., owing to their proximity to the foot-paths, if placed on the sides, accidents would be numerous and continual to children and others trespassing on them, which would almost entirely be obviated by their being placed on the centre of the street. The mean width of the Birmingham road is thirty feet; now a double tram-road, constructed to a guage of five feet, and allowing a distance of two feet between the two lines, is twelve feet, leaving a space of nine feet on each side for the use of the public, which I am certain is wide enough to allow an unobstructed passage to all sorts of agricultural produce.

There is another method, and which was recommended by Mr. J. Mackneil, engineer to the Holyhead-road, to the committee above mentioned, and that is, to have a portion of the road paved in a firm and even manner, and the materials cemented together, so as to form a solid mass; the part so paved to be appropriated for the express use of the steamers. "I am sure," says that gentleman, "it could be done without difficulty, and if well made, would fall little short of a rail-road. The following table, as calculated by him, shows the traction required to propel a stage coach over the undermentioned materials:—

On a well-made pavement	33 lbs.
On a broken stone surface, and on an old flint road	65
On a gravel road	147
On a rough pavement foundation	46

The above gives a decided advantage to stone paving for a road over any other substance of the kind, and I trust ere long, the one or the other I have mooted will come into general use. In my next I will inform "C. H. S." more fully than hitherto, the effects of the railway; and till then allow me to refer him to No. 90 of your useful miscellany, where the description of the "White Horse Inn, Redbourn," will, I hope, satisfy him that I have not exaggerated my statements.

I remain, Sir, yours, &c.

T. S. BROWNE.

P.S. In my last letter, for 2*s.* 7*d.* per mile, read 2s. 1½*d.*; and for 50 passengers conveyed for one-eighth, read 50 passengers conveyed for eight-elevenths of the cost.

BUILDING.

(No. 3, continued.)

GENERALLY speaking, an arch of four and a half inches thick is sufficient to be turned over a beam. The Skene back of an arch is the angle to which the bricks are laid. It is evident, that the mass of brickwork under the windows or doors, cannot support any other weight of the building except itself; consequently, the piers between the windows have to support nearly all the weight of the building. To disperse the weight more equally throughout the building, inverted arches are sometimes turned a short distance under the opening; which, by turning the weight gradually under the window, causes it to support a greater share of the weight, than it otherwise would have done.

I think, from the foregoing remarks, it will be impossible to misunderstand the principle and use of the arch; but it may be necessary to mention the method of constructing them. A centre being provided, and shaped to the desired curve, it is fixed against the sides at the top of the opening, and on this, the bricks are placed after the manner I have before described; when the arch is finished, the centre is allowed to remain until the arch is perfectly dry. In fire-places, a chimney-bar made of iron is used, the ends of which are let into the wall on each side; and on this the bricks are laid: and the bar being of iron, is allowed to remain; so that there is both an arch, and a bar to support the weight above. The arches generally used for fire-places, are plain.

The only part now remaining to render the window complete, with the exception of the woodwork, is the sill, which is generally of stone. On each side of the opening and bottom of the window, a space of one quarter, or half a brick is left, into which the ends of the sill are fixed; but if the top and bottom of it be parallel with the courses of bricks, the rain will lodge on it, and, instead of dropping off, will sink into the wall. To remedy this, the top of the sill is made to slope from the wall, that the water may run down; this is called *weathering*; and as the bottom ought to be parallel, near the edge a concave groove ought to be cut, so as to prevent the rain from passing it, and which is termed *throating*. The arches being turned to the windows and doors, the brickwork is carried up on the same principle as I have before mentioned, until the height of the next story is attained; when a diminution in the thickness of the wall will take place, which is generally advisable, for the sake of economy, and which, if carried up the same thickness, would prove of no essential service to the edifice; but would rather injure than benefit the wall. This diminution is performed inside the building, so that the exterior remains perpendicular. The scale of diminution, in most cases, is as follows; if in the lower story the wall be two bricks thick, the diminished wall in the next story will be one and a half brick thick, and in the story above, one brick. In buildings of great magnitude, the walls must necessarily be thicker; but the diminution is preserved after the above scale.

It may not be amiss to mention, it is desirable to strengthen the angles of a building as much as possible. To effect this, it is needful to place the quoin stones as at F in the diagram; which must, by their being larger and stronger, keep the angles together better than bricks, and, by their offering a greater resistance to water, or anything knocked against, must prove very essential to the building. When quoins are not used, pilasters are sometimes introduced; and which, being half or a whole brick thicker, must be stronger, and will require a greater force to injure them.

I think, from the example I have given of one story, the detail of which I have fully explained, by attention being paid to it, a building of any magnitude could be constructed, as it follows on the same principle throughout; the only difference being the diminution of the thickness of the walls. We will therefore pass over the remaining stories until the top of the upper one is attained, above which a one brick wall is carried up until it reaches a sufficient height, called a parapet; and which appears to answer the purpose of a gutter, and to prevent any person on the roof from falling off. This, and all walls, are generally covered with a coping of stone, weathered and throated on the same principle as a window sill; the object of which is to produce a good covering for the wall from the rain, or anything that would damage it. Sometimes, two rows of plain tiles, laid to project on each side over the wall, and on them a row of bricks on edge, are substituted instead of stone, being cheaper; but stone is preferable, inasmuch, as it is stronger, lasts longer, and offers a greater resistance: besides which, it produces a better appearance.

ARCHITECTOR.

NEW SYSTEM OF PROPELLING CARRIAGES UPON RAILWAYS.

Mr. Clegg, the author of this invention, remarks, that in the present system of locomotion, when great speed is required, it is necessary to increase the solidity, and, consequently, the weight of the engine; from which it results, that the weight of the engine becomes as great as that of all the carriages attached to it; so that a considerable portion of the power is expended in sustaining the motion of the engine itself, without being available for propelling the train. Steam is the power employed by Mr. Clegg, but instead of moving with the train, the engines are fixed at certain distances from each other along the whole length of the line of road; their action consists in forming a vacuum in a cylinder, the piston of which is put in motion by the atmospheric pressure, and it is this piston which is to draw after it the whole train of carriages.

This idea is not new, but Mr. Clegg's application of it bears no resemblance to anything that has hitherto been proposed. It has been suggested that letters might be conveyed by this means in the interior of the cylinder, and the rod which united the letter bags to the piston, was parallel to the axis of the cylinder. In Mr. Clegg's arrangement, the rod is perpendicular to the direction of the tube, which must consequently be so constructed as to open throughout its whole length in order to allow the rod to pass. This is effected by means of a longitudinal slit in the tube, which is covered with a continuous leather valve, strengthened on the outside by bands of metal.

The train is fixed to the piston by means of the projecting rod: at the other extremity is the engine, which, before the departure of the train, has formed a vacuum in a great capacity; which, by turning a cock, may be put in communication with the tube; the air contained in the tube rushes into the empty space, and the external air impels the piston, causing it to move forwards with the whole train attached to it. As the rod proceeds, it opens the longitudinal valve, which closes again as soon as the rod has passed. The piston having thus arrived at the end of the first tube, is carried forward by the momentum of the train, and enters into a second tube constructed like the first, and terminated by another engine, and so on to the end of the journey. The vaves are supplied with tallow, and a hot iron follows the rod and melts the grease, which leaves the valves perfectly air tight. Mr. Clegg thinks that his plan will be found more economical than locomotives, and less expense will be incurred by levelling, as he expects to travel with steeper gradients than are admitted for locomotives.

BRITISH NAVY.

We have the authority of Sir John Barrow for the correctness of the following statements:—

England has of first-class ships of the line, from 100 to 120 guns, 19; viz., in commission, 4; in ordinary, 12; building, 2. Second class ditto, from 80 to 100 guns, 24; viz., in commission, 5; in ordinary, 12; building, 7. Third class ditto, from 70 to 80 guns, 47, of which 12 are in commission, 33 in ordinary, and 2 building. First class frigates Razees and 60, 11; 1 in commission, and 10 in ordinary. Second class ditto, 50 and 52, 10; 1 in commission, 7 in ordinary, and 2 building. Third class ditto, from 86 to 50, 72; 7 in commission, 57 in ordinary, 8 building. Total, 183, which is nearly equal to the combined forces of France and Russia, and nearly four times that of the United States of America. The total numbers of ships and frigates in the navies of the four greatest maritime powers, are thus given by Sir J. Barrow:—

England. Ships of the line, 90; frigates, 93; total, 183.

France. Ships of the line, 49; frigates, 60; total, 109.

Russia. Ships of the line, 50; frigates, 25; total, 75.

America. Ships of the line, 15; frigates, 35; total 50.

Sir J. Barrow remarks, that "At no former period of profound peace, in the whole history of Great Britain, was their navy in so efficient a state, as to the number, condition, and equipment of the ships in commission, and the number and superior qualities of the petty officers and effective seamen borne on their books; nor were the number, the dimensions, and the condition of the ships in ordinary, and the preparation and stores in the dock-yards for increasing the active and efficient force of the fleet, at any time more satisfactory than at the present moment—the commencement of the year 1839."

To Draw Figures in Gold on Ivory or White Crockery.—First draw any design with sulphate of iron, then dip it in nitromuriate of gold.

THE TEETH.

To the Editor of the Mechanic and Chemist.

Sir,—Perceiving the laudable promptitude with which questions of the first importance to science and art, are answered in your intelligent "Mechanic and Chemist," I am induced to propound one to your chemical correspondents particularly, which, as my Lord Bacon would say, "comes home to every man's business and bosom;" and will, I trust, be deemed of such importance, as to plead an ample apology for thus obtruding myself upon their attention.

To the human form divine, those elegant appendages, the teeth, are of the utmost consequence: and I am, unfortunately, one of a legion suffering from decayed teeth to an extent so alarming, as to excite an apprehension, that I shall soon be deprived of the power of mastication.

To stop the progress of this lamentable decay, is my aim and object in addressing you, in the confident hope, that some of your intelligent readers will be able to inform me how to prepare and apply an innoxious and effectual cement to fill up and strengthen the decayed parts; and thereby render them useful in mastication, and restore them, in a degree, to their primitive beauty and utility.

My dentist, a gentleman of repute and great experience in his profession, being of opinion, that no effectual cement can be contrived; and instances the cases of failure, detailed and published by the Editor of the Lancet, three or four years ago, as proofs of the correctness of this opinion.

I being, however, one of those philosophers who conclude, that for every wherefore there is a why; and, that there is no evil without a remedy; respectfully submit this dubious point to the best and earliest attention of those gentlemen, able and willing to give the required information through this medium; and for which, I certainly shall feel greatly obliged.

Yours, &c., Albinus Tusculum.

REPRODUCTION OF THE IMAGE OF BODIES BY PHOSPHORESCENCE.

The Abbè Moigno has found, in a work of Beccari, an Italian physician, (*De quamplurimis phosphorus*. Bolog. 1744.), some curious facts, which have some analogy with those observed by M. Daguerre, and communicated, by M. Arago, to the French Academy. We extract the following from the communication of M. Arago: "It is known, that certain bodies, when exposed to the light of the sun, will remain luminous; some, during several minutes, and others, during hours after they are removed into the dark. M. Daguerre, whilst experimenting with the sulphate of barytes, observed a very remarkable effect: he had placed the pulverized substance in a plate, which he laid several times in the sun, and afterwards withdrew it into his laboratory. While holding this plate in his hand, he had occasion to go into a dark part of the chamber; there, he not only found the bottom of the plate appearing luminous, but it appeared transparent: for he could distinguish the form of his hand through the substance of the plate. By filling a bone with this substance, and applying sufficient heat to render the bone perfectly white, he obtained a substance which remained luminous during several days.

The experiment described by Beccari, is as follows: A sheet of common paper, placed upon a heated gridiron, and then exposed to diffused light, shows, when removed into a dark chamber, an image of the gridiron, which is particularly brilliant, on the side which was not in contact with the iron. When the paper is placed upon a disc, a similar effect is produced. The same writer (Beccari) remarks, that the phosphorescence is most brilliant, when the paper is most promptly and effectually cooled. He also discovered, that glass diminishes the phosphogenic power.

Railway into the Heart of the City.—On Thursday last the Court of Common Council, with one dissentient voice, determined upon opposing the introduction into the heart of the city of the Blackwall Railway, and a petition to Parliament will be presented accordingly. The project is also opposed by the inhabitants and owners of property in the parishes and wards through which the proposed railway would pass. This is the third application to Parliament to repeal so much of the Railway Company's Act of the 6th and 7th of William IV., c. 123, as interdicts the admission of the line into the city, and fixes the terminus and depôt in Goodman's-yard, east of the Minories. If this project should succeed, it would probably be followed by several of the other railway companies, whose depôts are now most properly confined by law to the outskirts of the metropolis, and thus not only constitute an intolerable nuisance in the centre of the city, but interfere with some of the important public improvements now contemplated by Parliament and the Corporation of London.—*Times.*

THE CHEMIST.

CURSORY REMARKS ON TOXICOLOGY.

NO. VI.

The natives of South America and of Guiana especially, possess the art of making a variety of deadly vegetable poisons. §

The settlement of Esmeralda is the most celebrated spot on the Orinoco for the manufacture of the curare, a very active poison, employed in war and in the chase, as well as a remedy for gastric obstructions (indigestion and weakness of the stomach). Erroneous ideas had been entertained of this substance; but our travellers had an opportunity of seeing it prepared.* When they arrived at Esmeralda, most of the Indians had just finished an excursion to gather juvias (the fruit of the bertholletia) and the liana, which yields the curare. Their return was celebrated by a feast, which lasted several days, during which they were in a state of intoxication. One less drunk than the rest was employed in preparing the poison. He was the chemist of the place, and boasted of his skill, extolling the composition as superior to anything that could be made in Europe. The liana, which yields it, is named bejuco, and appeared to be of the strychnos family. The branches are scraped with a knife, and the bark that comes off is bruised and reduced to very thin filaments on the stone employed for grinding cassava. A cold infusion is prepared by pouring water on this fibrous mass in a funnel made of a plantain-leaf, rolled up in the form of a cone, and placed in another somewhat stronger, made of palm leaves, the whole supported by a slight frame-work. A yellow fluid filters through the apparatus; it is the venemous liquor, which, however, acquires strength only when concentrated by evaporation in a large earthen pot. To give it consistence, it is mixed with a glutinous vegetable juice obtained from a tree named kiracaguera. At the moment when this addition is made to the fluid, now kept in a state of ebullition, the whole blackens, and coagulates into a substance resembling tar, or thick syrup. The curare may be tasted without danger, for, like the venom of serpents, it only acts when introduced directly into the blood, and the Indians consider it as an excellent stomachic. It is universally employed by them in hunting, the tips of their arrows being covered with it; and the usual mode of killing domestic fowls, is to scratch the skin with one of these infected weapons."

* Macgilivray's Abridgment of Humboldt.

Cassava, to which allusion is made in the preceding extract, is the root of the iatrophia manihot. Every part, *when raw*, is fatally poisonous. Its noxious quality is, however, entirely destroyed by heat; the juice is boiled, with meat and spices, into a wholesome soup; the filaments of the root are ground into cakes, which form the principal food of the natives; hence it is called "pain de Madagascar" (Madagascar bread). It is a native of three quarters of the world. It may here be mentioned, that many of the African tribes are in the habit of swallowing the venom of serpents as a specific against their bite.

Waterton describes the wourali, another South American poison, which is made by the Macoushi Indians from a vine called wourali, several unknown vegetables, two species of ants, Indian pepper, and the pounded fangs of two species of venemous snakes. These romantic ingredients put us very much in mind of the witches' cookery scene in Macbeth. The poison is prepared by boiling; and an ox wounded with arrows dipped in it, died in twenty-five minutes. It is supposed to kill without causing pain.

The *prompt* administration of warm water alone, in the case of mineral and vegetable poisons, is generally of more utility than the utmost endeavours of the physician, or the whole ingredients of the Materia Medica, after delay has taken place. If an enemy gets into a fortress, the object is to expel him, or if he cannot be expelled, to render him as harmless as possible. The first end in the present case, is to be obtained by emetics, and the last may occasionally be produced by dilution; for in proportion as the quantity is increased by the addition of simple element, so the solution becomes weaker.

"With regard to the use of antidotes," says Forsyth, "it has been already stated, how little they are to be depended upon. In certain cases, however, we are bound to acknowledge their power; but they should be very rarely trusted, unless subsequent to, or in conjunction with, the operation of an emetic. In many cases, the effects of this latter remedy may be promoted by the ingestion (swallowing) of liquids holding the particular antidote in solution,—a practice which offers the double advantage of accelerating the elimination (vomiting) of the poison, and at the same time of decomposing any which may remain. Orfila has fully established the fact of albumen being a counter-poison to corrosive sublimate (oxymuriate of mercury); vomiting may, therefore, be very judicious-

ly promoted in cases of such poisoning, by water holding the white of egg in solution. With equal effect where verdigris has been swallowed, sugared water may be used as a diluent to encourage emesis, and muriate of soda (common salt) in solution, will be found the most efficient antidote to nitrate of silver, and sulphate of magnesia to acetate of lead. Where an emetic salt, like tartarized antimony, has been taken, copious dilution with common water will in general so provoke vomiting, as to render it its own antidote; but it may be useful to remember, that the infusion of galls, and, according to Berthollet, the decoction of bark, at the temperature of from 30° to 40² Fahrenheit, have the power of decomposing it, while Orfila considers milk the most efficient counter-poison to the sulphate of zinc."

It may, perhaps, be expected, that something should be said on the subject of chemical tests for poisons. The writer would be happy so to do; but on reference to Vol. II. of the "Mechanic and Chemist," at pages 71, 95, 111, 119, and 127, he finds the subject treated in a much abler manner than would lay in his power, and by a much abler pen than his own.

One of the best methods of preventing accidents from poison, is the extension of the circulation of works having for their object the diffusion of chemical science, amongst which, the "Mechanic and Chemist" is fairly entitled to a prominent rank.

To be useful to his fellow-creatures, should be one of the proudest aims of man. Such was the writer's object in penning the present article; and he therefore trusts, that however feeble or insignificant they may be, that still no apology is necessary for his "Cursory Remarks on Toxicology."

VANDERKISTE, Jun.

WESTMINSTER MEDICAL SOCIETY.

NOXIOUS STOVES.

ON Saturday evening Dr. Golding Bird brought before the notice of the meeting the subject of the effects produced by carbonic acid gas as a poison upon the animal economy. He remarked, that the popular excitement upon the subject the last few months, on account of several alleged fatal cases from patent stoves, had drawn his attention to a subject on which there was so remarkable a discrepancy amongst writers. The important question was as to whether it acted as a specific poison, or merely by depriving the air of its proper proportion of oxygen, and high authorities might be adduced on each side of the question. It is a popular, though a mistaken notion, that if no vapour is given off in the combustion of charcoal, it is not unwholesome, as where the charcoal is slowly consumed, as in the common chafing-dishes and Joyce's stoves, it never gives flame, and the heated atmosphere, which will have but little influence on the thermometer, is not sufficiently heated to produce the mirage. Amongst additional cases of the poisonous effects of the patent stoves, he mentioned that of a young gentleman at Tooting who used one in his study, upon whom a very serious and alarming effect was produced. In the recent case, at the church of Downham, two of these stoves were employed about 14 feet apart, and had been used some time previous; but on the occasion when the accident happened, the day being intensely cold, the stoves had been lighted some hours previous, and the doors and windows carefully closed, so that the congregation went into an atmosphere impregnated with carbonic acid gas. In contradiction to the professional opinions given by Messrs. Brande and Cooper, at the recent inquest in the city, this was a practical experiment on a large scale, that the products of the combustion in these patent stoves did not ascend to the top of the building, because the charity children who sat at the lowest part of the church were the first affected, and afterwards those above them; but there was only one person, who was a delicate lady, affected in the gallery. After adverting to the different opinions entertained by writers on the poisonous agency of carbonic acid gas, and adducing several cases, Dr. Bird gave it as his opinion that it acted as a specific poison upon the extremities of the nerves, and adduced experiments to show that a proportion of 50 per cent. in atmospheric air, and even less, would be destructive to human life. As so much popular as well as professional ignorance exists upon the subject, it is to be hoped that the discussion, which will be resumed at the next meeting, will be instrumental in preventing further loss of human life by any of those plans where charcoal is used in any form without due means for carrying off the products of combustion.—*Times.*

To Silver Brass or Copper Ornaments.—Alum-grain, tin, and white tartar, proportioned to the articles to be coloured, put into an earthen vessel with the things, and the whole boiled together, the tin is soon found adhering to the articles; which, when polished, look like silver.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, March 67, Dr. Truman, on Comparative Physiology. Friday, March 29, Institution closed.

Tower Street Mutual Instruction Society.—Monday March 25, Quarterly Meeting. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. — Tuesday, March 26, Quarterly Meeting. At half-past Eight.

Poplar Institution, East India Road. — Tuesday, March 26, Mr. Haydon, on Painting. Friday, March 29, Discussion on Apparitions.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 26, John King, Esq., on the Life and Works of Raphael. At half-past Eight.

Society for Promoting Practical Design, Saville House. Leicester Square, Monday, March 25, Edward Cooper, on the Application of Machinery to Engraviug. At a quarter past eight precisely.

London Temperance Institute, 167, Fleet Street.—Friday, March 29, Mr. J. F. Vicary, on Phrenology, in conclusion. At Eight.

Greenwich Society, 15, Nelson Street, Greenwich.—Tuesday, March 26, Mr. Searle, on the Writings of Charles Dickens, in continuation. At eight precisely.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—I shall feel obliged through your publication if I could be informed of the ingredients to compose fumigating pastiles, and how they are made. How to make Eau de Ventina? Also the composition to fill decayed teeth? And a sure and certain remedy for corns. Mentor.

Sir,—Can you or any of your correspondents inform me how I can break china in any required direction.
Derby. J. B. H.

Sir,—Will any of your scientific correspondents inform me how the leaders or quick-match (I think they are called) to fire-works are made, so as to light the different parts of the device at the same moment?
J. K.

Sir,—Can any of your Correspondents give me a receipt for making naptha to burn in a lamp? Also, how to separate water from carbon in sugar? An early answer will oblige. J. L.

ANSWERS TO QUERIES.

Sir,—I beg to inform your correspendent "Thermometum," that the proportions in Gray's receipt are incorrect, and that the following is correct:—Two drachms of camphor; purified nitre, half a drachm, and half a drachm of muriate of ammonia, are to be pulverized and dissolved in two ounces of proof spirits. The mixture is then to be put into a bottle or tube of glass about ten inches long, and three-quarters of an inch in diameter, the mouth of which must be covered with a piece of bladder, perforated with a needle. Luna.

Paste for Razor Strops.—Sir, Some time since I noticed in the "Mechanic and Chemist," an inquiry how to make the paste for razor strops; in reply I beg to state, that the essential article in making it is putty powder, and I believe is what would be called an oxide of zinc, much used in polishing glass and steel. I would advise the paste to be made with lard, and if wished to be black, coloured with the finest vegetable lamp-black, which may be had free from grit of any kind. B. W. H.

"H. E. T." A very excellent paper cement is described in No. 121.

"R. S. Holborn." To procure skeletons of small animals, is described in No. 116 and 117.

"C. C." A very simple and economical machine for making covered wire, is described in No. 120.
W. P. C.

TO CORRESPONDENTS.

Lima.—*If the receipts are really good, we shall be happy to insert them.*

S. S—*Nitrous oxide, or protoxide of azote, was first discovered by Priestley in* 1772, *but its peculiar properties were not known until* 1799, *when Sir H. Davy ventured to inhale it, although it had been previously supposed to be fatal to life when received into the lungs. and thus discovered the extraordinary effects which suggested the appellation of "laughing gas." After a few inspirations, an agreeable sensation is experienced, and a desire to inhale the gas; if the respiration be continued, a kind of somnambulism is produced, during which, a variety of incoherent ideas crowd upon the mind; the exhilaration becomes so energetic, that the propensity to laughter is irresistible, and accompanied with grotesque contortions of the body, and violent muscular exertions, which appear to be performed with perfect ease. These effects continue some minutes after the gas has been inhaled, and then gradually subside till the system recovers its former tranquillity. and no subsequent depression or lassitude is experienced, as is usually the case after the cessation of a violent stimulus. This gas may be obtained by various processes*; *it is disengaged in a state of mixture with nitric oxide and nitrogen, while some metals are dissolving in nitric acid; but the process most commonly employed, is the decomposition of nitrate of ammonia by heat. The heat required for this purpose is from* 320° *to* 500°. *At about* 600° *the decomposition takes place with an explosion, and other substances are evolved; this should be guarded against by attention to the heat, which should never exceed* 500°. *The utmost caution is necessary in experiments of this dangerous nature; if* nitric *were mistaken for* nitrous *oxide, instead of laughter, death would be the consequence of inhaling it.*

J. W.'s *problems require only a knowledge of the well-known properties of right-angled triangles. The diameter of a circle is the diagonal of an inscribed square; therefore the square of a side is half the square of the diameter. Again, if a side of the square be bisected, and a perpendicular be drawn to the circumference, it is evident that such line must be half the difference of a side and diagonal of the square, and may be determined as above stated.*

G. V.—*Platinum mixed with copper, imparts a golden colour, and the compound is harder, susceptible of a finer polish, and less subject to rust, than pure copper. Small quantities of platinum may be dissolved in nitro-muriatic acid; a precipitate is obtained from this solution, by adding a solution of muriate of ammonia. This precipitate, exposed to the action of a fire gradually increased to intense heat, is converted into a spongy metallic mass, which becomes more dense by forging at a red heat.*

We have received several answers to Mr. Blesson's *geometrical question, but they are all inaccurate. We should feel much pleasure in presenting our readers with a solution from the distinguished geometer who proposed the problem.*

J. B's *paper will appear as soon as the engraving is ready.*

All communications to be addressed to "The Editor of the Mechanic and Chemist, City Press, No. 1, Long-lane, Aldersgate."

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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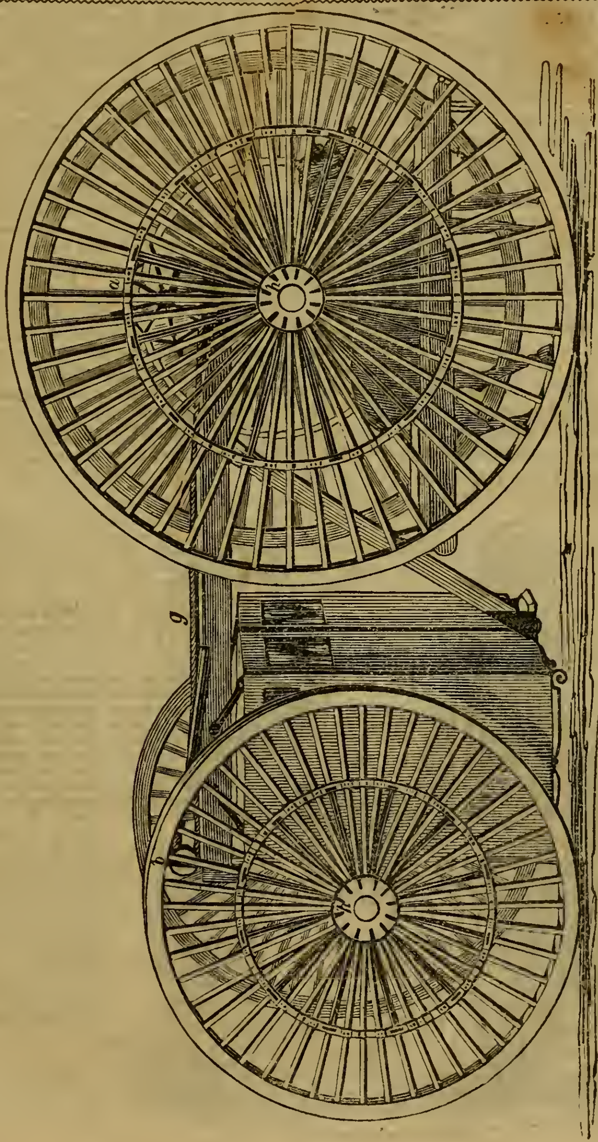


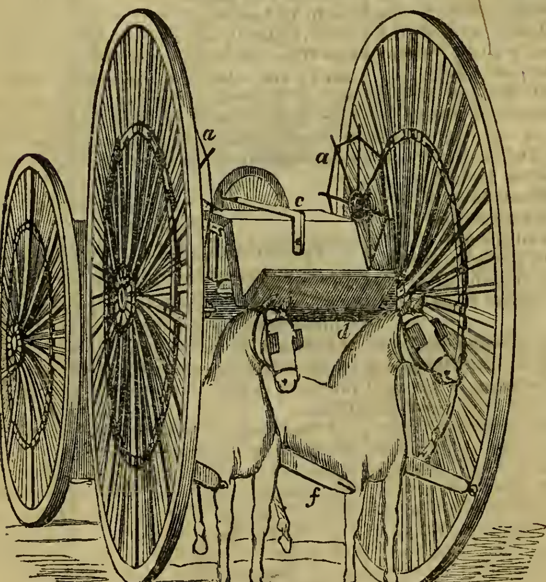
CURRUS MONSTROSUS, OR GIANT VELOCIPEDE.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

CURRUS MONSTROSUS.

In conformity to the taste of the day, we give this outlandish appellation (*pro tem.*) to a machine which has been exhibited, some days past, in the yard of the Bull-and-Mouth Inn. In travelling through a hilly country, in a carriage drawn by horses, it must be evident to every one who has directed his attention to the subject, that much animal power is lost in every descent of considerable inclination; in an ascent, the horses have to overcome the whole effect of gravity, friction, and the impediments caused by inequalities on the surface of the road. If the arrangement were purely mechanical, the power expended in raising the weight up an inclined plane, would be compensated by the same force of gravity being made available in the descent; but in an ordinary carriage, moved by horse power, this is not the case; for although the force of gravity is sufficient to cause the descent of the carriage, and it is often necessary to have recourse to a drag to regulate that force, there is, nevertheless, a considerable consumption and waste of animal power in the locomotive exertion of the horses, which imparts no impulse to the carriage. The extraordinary machine, an engraving of which is given in the front page, has to a certain degree obviated this evil; but the means employed to effect this purpose are so singular and extravagant, that if it were a dream, it would almost be denominated a night-mare. It is drawn by two horses; a broad band is placed under their "centres of gravity," terminating on their backs by eight strong leather straps on each side; a cylinder is passed through the loops of these straps, and a thick rope, furnished with an iron hook, is fastened to the centre. When, in a steep descent, the services of the horses are not required, the conductor, by means of a wheel and axle, lifts them from the ground, and keeps them in a state of perfect dependance, in the position of the golden fleece, till level or ascending ground again requires their labour. There are four monstrous wheels to the carriage, the fore wheels being about twelve feet in diameter. There is less friction on the axle with large wheels than with small ones; but this is a very small and inconsiderable item in the whole amount of resistance; stones and other obstacles on the road are also more easily overcome, because their resistance is more gradual; beyond this, no advantage is derived from wheels of such exorbitant dimensions, and the inconvenience of unwieldy and almost unmanageable machines of this description, especially on crowded roads, must be manifest to every one.

Fig. 2.



Description of Engravings.

Fig. 1, *a*. wheels for raising the horses; *g*, the rope attached to the break; *b*, the pulley, over which the break-rope passes, and is then carried to the seat in front, occupied by the two steersmen; *f*, the shafts.

Fig. 2, *a a*, the two wheels used for raising the horses; *c*, the lever, to the end of which, below the seat, the break-rope is fastened; *d*, the axle; *f*, the shafts, to the ends of which, strong breast-bands are fastened for the horses to press against. The break is a transverse piece of wood, made to press on the hind-wheels; one end of which may be seen in Fig. 1, under the rope at *g*; it is bolted in the centre to the strong piece of timber which connects the fore and hind-wheels, and which can be raised or lowered at pleasure by means of the break-rope.

BUILDING.

NO. IV.

THE exterior brickwork being completed, occasionally parts of the building are covered with a composition called stucco; for the use of which, substantial reasons can be assigned. The appearance is preferred before brickwork by many, as it causes variety; is a good substitute for stone, and produces a beneficial and very advantageous covering for the walls.

There have been so many different methods of making stucco invented, that it would be an almost endless and useless task in describing them. A good covering for walls can be composed of clean sand and the best lime, in the proportion of three-fourths sand to one-fourth lime; but one more desirable is composed of about three-fourths good sand, to one-fourth Roman cement. These compositions are very well calculated for some walls; but when the stucoo is intended to resist water, or near the water-side (as it is likely to be injured by the spray), a portion of metallic oxide should be one of the ingredients; which, being mixed with the last-mentioned composition, would prove as effectual as free-stone. It was with a composition similar to this, termed tarras, that the Romans used in the erection of the skirts of the bay of Baiæ.

Before the composition is laid on the wall, the joint of mortar between the bricks ought to be raked out, and the bricks, which are generally much inferior to the others, ought to be *pricked;* the object being to render the adhesion of the stucco to the walls as firm and lasting as possible. The walls are then brushed down to erase the dust, and entirely wetted; after which, the sluice is laid on in a liquid state, and is rubbed down with a hard float, to produce a smooth and even surface, care must be taken that the stucco is perpendicular, and also perfectly plumb. When the composition is nearly dry, the grooves which generally appear in stuccoed walls, are cut.

Corners are generally composed of stucco, with which plaster-of-Paris is sometimes mixed, but by its offering a less resistance to the weather, weakens the cornice, and consequently its absence is very desirable. For exterior and continuous cornices, a protrusion of bricks, or tiles, will be required to form a corner, which greatly adds to the strength of the cornice. The next thing to be performed, is to fix strait edges to the wall, at the top and bottom of the cornices, parallel to each other, termed *greeds,* to act as guides to the moulds. Moulds are pieces of wood or metal; metal is preferable in large projecting cornices, when they are inserted in a wooden frame with moulds; the different mouldings are inversely cut. The moulds being applied to the screws, a workman lays on the composition, while another works it backwards and forwards, thereby striking off all the unnecessary protuberance, and reducing the cornice to a perfectly smooth surface, and to the desired shape. The mould ought to be drawn off at the end, not taken down at right angles, on account of its liability to tear off parts of the cornice. Many of the angles cannot be completed by the moulds, consequently are burnished by a jointing trowel, which is made very thin, and the angle a sharp acute angle. These jointings are called mitres.

All the exterior cornices ought to be weathered and throated, which is performed on a principle similar to that used for a window-cill; the upper moulding being made to slope gradually from the wall, and the throat forming part of one of the under mouldings.

The following general remarks deserve the particular attention of the builder. Brickwork ought not to be carried on in frosty or wet weather, as, in the former case, the frost causes the mortar to crumble away; and, in the latter, the wet gets into the wall and injures it; but the walls ought to be covered with straw, and on it pieces of plank ought to be laid to prevent the straw from being knocked or blown away; and when the walls are intended to be left untouched for some time, an inferior kind of cement might be poured on the wall, which prevents any injury that might accrue from their being left uncovered.

ARCHITECTOR.

EMIGRATION TO AMERICA.

To the Editor of the Mechanic and Chemist.

SIR,—I have been living six years in the United States of America, and in the way of business, have travelled through eight of those states, and two territories; but my home is now in the north-west part of Illinois.

I feel desirous of informing some of my countrymen about that part of the world, through your very excellent little work, which ought to have a circulation far and wide. The city of New York is the London of America, where are to be found people and merchandize of all nations; many mechanical trades are carried on here, and, unfortunately, often too much

crowded with emigrants from Europe going there under the very foolish impression, that there they must become rich as a matter of course. Many land without money, and cannot get employ, consequently repent, for rents are high, and provisions not cheap; flour about 2*d*., beef, 5*d*., and vegetables dearer than here. The best plan is generally for mechanics to proceed to the interior cities, towns, or villages, where chances for work are better, rents lower, and provisions cheaper; even if a man has cash sufficient to embark in business, it is best to take a situation for a while to learn the ways.

Emigrants proceed generally westward when leaving New York, either by steamboats, canals, or rail-road, and lakes; again by steam-boats through the flourishing cities of Albany and Troy, and past many good towns on the Hudson River, 160 miles from New York; the former a place of great commerce, and having about 30,000 inhabitants, the latter having about 20,000 inhabitants, a pretty place and good trade; thence through the city of Schanectady, 10,000 inhabitants, by rail-road or canal to the clean and beautiful city of Utica, having 20,000 inhabitants. The steam cars travel at the rate of eighteen miles an hour, and charge about twopence per mile; the canal boats, fitted with genteel cabins, with berths for sleeping in, travel night and day, charge 1¼*d*. per mile, and give three meals a day, or three farthings per mile without meals, and generally go at the rate of sixty miles a day. Passengers proceed on through other towns to the city of Rochester, on the Genesec River. This place has great water power, and much used for grinding and manufacturing, 25,000 inhabitants; thence passing on within eleven miles of the great falls of Niagara (a visit to which I would by all means recommend, for it is really "awfully grand"), to the city of Buffalo, at the termination of Great Western Canal, 364 miles long from Albany; thence by steamboats up Lake Erie, St. Clair, and Lake Michigan. I am now in the far west, about 1800 miles from New York.

There is another route to the west much travelled, viz., from New York to Philadelphia by rail-road, 90 miles; thence by canal to Pitsburg, 300 miles. This place has about 30,000 inhabitants, and is called the Birmingham of America; but although there are many iron and glass, as well as other works, it produces scarcely any of those lighter wares of iron, steel, brass, and such like fancy goods. Its manufactures are confined mostly to boat steam-engines, agricultural implements, and heavy works of utility; one plough factory averages 50 ploughs a day. This place is the head of Great Western Valley, commencing with the Ohio river, down whose stream the merchandize and population of the world is borne. About 300 steam-boats are engaged in the trade of the Ohio, its tributaries, and its recipient the Mississippi, "the father of rivers;" but for these, this great valley would be possessed only by the savage Indian "in search of prey." It is smiling with plenty, and the abode of civilized man.

Stubenville, in Ohio, is a weaving place; Wheeling, in Virginia, similar trade to Pitsburg, but having only 10,000 inhabitants. Cincinnatti is the great emporium of trade in the state of Ohio; it is a fine place, and has about 30,000 inhabitants. Within forty years it was a forest. It may now vie with any city of its size in the world; its moral and commercial influence is felt in the whole western region. Passing on, we come to Louisville, a city in Kentucky; also a very fine city, with a good trade, and contains about 20,000 inhabitants. Tobacco is cultivated in this state by slaves; it sells for about 4*d*. per pound in the leaf. Thence onward, down stream, either to the city of New Orleans, about 1200 miles, or up the Mississippi to the city of St. Louis, in the state of Missouri, about 15,000 inhabitants, a place of great trade, to the state of Illinois, the territories of Jowa and Wiscousin, lately acquired by purchase from the Indian tribes. The e western regions are fine in every point of view, and must, at no distant day, be the seat of the American republic. The soil produces in great abundance all sorts of grain, vegetables, and minerals. Many million acres are quite clear of timber, and only require ploughing and sowing to get crops. The clear land is called "prairie land," or natural meadow; it is only a dollar and a quarter an acre. There is enough to maintain one hundred million of inhabitants.

Travellers in the west view large and spacious plains on every side, strewed with groves, mantled with green, and beautiful; these are the gardens of the desert. The unshorn fields, boundless and fresh as the young earth, when Adam was its virtuous lord.

There are vast mines of iron, copper, and lead, &c., in the west, but still it does not fall to the lot of all who seek a home there to do well, or like the country; nor is it likely that mechanics, who have been used to cities and the conveniences of refined society, would resign themselves

without regret, to the privation of the comparative comforts and security which they enjoyed in their native homes.

I remain yours, &c.

AN ADOPTED AMERICAN.

SIR JAMES ANDERSON'S STEAM-CARRIAGE.

To the Editor of the Mechanic and Chemist.

Steam-carriage Waggon Company's Office, 18, Moorgate-street.

SIR,—I have received an official announcement that Sir James Anderson's steam drag is finished, and will be in Dublin in a few days.

I enclose a description of the carriage for passengers, to be attached to the steam-drag, which may be interesting to your readers, and which you will oblige me by inserting in your paper.

I am, Sir, yours, &c.

W. SHAW, Sec.

We have paid a visit to the coach factory of our talented fellow-citizen, Mr. Dawson, to see the first of a series of passenger-carriages intended for the "Steam-carriage Company of England," and to be drawn by Sir James Anderson's "steam-drag, which is shortly expected here, on its way to London. The passenger-carriage, it appears, is to be attached to the drag, as a coach to the horses, and the length of both together will be about the same as a coach-and-four. It presents a peculiarly safe and commodious appearance, and, from its construction, may be pronounced impossible to be over-set. The front body, which is entered at the side in the usual way, contains more than ample space for six passengers each, having an arm-chair, and as convenient, if not better and more comfortable accommodation, than the first-class railway carriages. The back body, which is entered at the rear, is intended for ten passengers, although affording sufficient room for twelve. It is so ample in its dimensions, that one may walk perfectly erect from end to end, without incommoding the passengers at either side. It is admirably ventilated and lighted, and is to be furnished with a peculiarly constructed table, supplied with the newspapers of the day. The outside passengers sit round the roof, fourteen in number, having foot-boards, like outside cars, and supported at the back by a railing; the carriage altogether containing thirty passengers. The front boot contains a cistern for water, and a space for coke or fuel for a stage of from ten to twenty miles; and there is room at different parts of the carriage for storage of about $1\frac{1}{2}$ tons of luggage, if necessary. We were particularly pleased by the light and elegant appearance of a machine intended for so many passengers, and cannot but feel gratified that Dublin can compete with England in furnishing these carriages for a company exclusively English. But Mr. Dawson has already supplied a number for the English railways. We understand the drag and carriage will be exhibited in Dublin previously to their embarkation; and we look with much interest to an adventure of so much national advantage."—*From Saunder's News Letter.*

AN experiment was made with complete success, with one of Daniel's galvanic batteries, under the superintendence of Colonel Pasley, of the Royal Engineers, at half-past two o'clock last Saturday, off the gun-wharf, Chatham. Thirty-five pounds of powder were exploded in about ten fathoms of water, the length of the wire conveying the electric fluid being 500 feet; it caused a most tremendous explosion. Three smaller ones were afterwards tried, but only one succeeded. There was a numerous assemblage of spectators. The *Royal George*, at Portsmouth, we understand, is to be blown up in a similar manner, and this experiment was preparatory to the attempt.—*Maidstone Journal.*

A New Railway Carriage—of what is usually called the third class, having neither roof nor enclosed sides, is destined for the Manchester and Leeds Railway. It is 17 feet $10\frac{1}{2}$ inches in length, and 7 feet $11\frac{1}{2}$ inches in width. The form of the carriage is not so square as those hitherto used, but more nearly resembling the form of a long boat, with the stem and stern cut off square. A bench seat extends the whole length of the carriage on each side, and down the middle is another broad bench, $27\frac{1}{2}$ inches in width, divided in the middle by an open rail, or back of wood, rising to a height of 14 inches from the seat, so as to form two benches, on which the passengers sit back to back. Allowing 14 inches to each passenger, the carriage would seat about 60 persons Ascent is had by two broad iron foot plates, at each corner of the carriage, so that there are four doors, affording ready ingress and egress. An iron rail extends along the sides of the carriage, so as to prevent any thing from falling over. The exterior of the carriage is painted an olive green, and is formed into pannels. The whole has a neat appearance, and is capable of accommodating a greater number of passengers than any carriage we have seen of equal dimensions.—*Manchester Guardian.*

THE CHEMIST.

ELECTRICITY.

NO. II.

It is evident, that the electricity produced by the means I have stated, must be capable of producing but very feeble effects. To obtain an increase, Otto Von Guericke, the inventor of the air-pump, filled a glass globe with melted sulphur, broke the glass, and mounted the globe of sulphur in a frame on its axis, so as permit it to revolve freely, while he applied his hand as a rubber. This was the first electrical machine ever constructed, and by its means he added materially to our knowledge of the science. Subsequent experiments proved, that glass answered much better for this purpose than sulphur, and that a cylindrical form is far superior to a spherical one, owing to its presenting a much greater surface for friction. The electrical machine most commonly used at present, consists of a glass cylinder, mounted in a mahogany frame, so as to turn freely on its axis, by means of a handle fixed on one end. On one side of the cylinder is placed a glass pillar, mounted with a *narrow piece** of wood covered with leather or silk, and stuffed with any soft substance (flannel answers very well); from the upper edge of this, a piece of black silk projects over the top of the cylinder, and hangs about half over the other side. The lower end of the glass pillar is fixed into a wooden cup, through which a screw acts on a short post fixed into the bottom of the machine; this is called the rubber. On the other side of the cylinder, another glass pillar is mounted; on its top is placed a wooden cylinder, with rounded ends, and covered with tinfoil; on the side nearest the cylinder it is armed with a row of pointed wires; this is called the conductor. Instead of wood, the conductor is frequently made of tin or brass, but the other does nearly as well. Some years after the invention of this apparatus, a society of Dutch chemists was formed for the purpose of investigating philosophical pursuits; they were experimenting with the electrical machine, passing a current of electricity from it into a glass of water, when a Mr. Cunens, happening to hold the glass in one hand, with the other touched the wire, which connected the water and conductor of the machine; he immediately received a violent shock in the arms and breast. Thus was discovered the Leyden jar, so named from the occurrence happening in the city of Leyden. Other persons repeated this experiment, and gave such wonderful accounts of its effects, that it was soon known throughout Europe, and many persons travelled about with machines to gratify the curious, by exhibiting its effects. One of the society I have spoken of, named Muschenbroek, declared he would not have a second shock for the whole kingdom of France, and others gave still more exaggerated statements of its effects. This shows, in a striking manner, the power of the imagination over the senses, for many persons now receive the shock with pleasure. It is quite clear the Leyden jar, in the form I have just mentioned, was but ill adapted for general use. It was soon found, that any conducting substance would answer as well as water, but that it was necessary to cover the outside as well as the other, in order to produce the required effect. Tinfoil being a very good conductor, was, therefore, employed instead of water, as it could be easily pasted on both sides of a glass jar; and in order to connect the inside with the machine, a lid was made to the jar, perforated by a wire reaching to its bottom, and mounted at the top with a brass ball. This is the present form of the Leyden jar. In my next, I shall proceed to notice the theory of electricity, which the celebrated Franklin founded on his experiments in this science.

ELECTRON.

Stepney, March 23, 1839.

* Instead of a *narrow piece* of wood, an acquaintance of mine substitutes a *broad* iron plate, which appears greatly to increase the power of the machine.

ON OXYGEN GAS.

To the Editor of the Mechanic and Chemist.

Sir,—In your number for February 23rd, I observed an article entitled "Poisonous Effects of Oxygen Gas," upon which I have taken the liberty to offer a few remarks.

It is a law of chemical combination, that when bodies *combine*, they form an entirely new compound, possessing new properties, and differing essentially from its parent substances. It is entirely erroneous to imagine, that bodies, thus combining, form a compound which shall possess the united properties of those bodies. This may be proved by numerous examples: as for instance; chlorine, an eminently noxious gas, combining with sodium, a metal, forms our common salt. The two gasses, oxygen and hydrogen, combine to form water; and hundreds of similar examples might be adduced. Now, what similarity is there, between these combining bodies, and the products of their combination?

If the poisonous property of the metallic oxide, mentioned in the paper I have alluded to, depends, as therein stated, upon the oxygen which enters into their combination; why should we not find the same result in all the other combinations of oxygen? Why should not water, for instance, be poisonous, or oxide of iron, or the very air we breathe?

But, independently of this, pure oxygen does not possess that acrid property which is, in the before-mentioned article, ascribed to it. This gas, when inhaled in a pure state into the lungs, (the extreme delicacy and irritability of which organ are well known to everyone,) produces the most pleasant and exhilirating sensations. In cases of pulmonary consumption, when this malady has committed its terrific ravages, and the lungs have become morbidly sensitive; the inhalation of this gas produces a temporary relief almost magical. Were oxygen of an acrid or caustic nature, what would be its effects on the lungs, when under the influence of this disease? That many of the metallic oxides are eminently poisonous, no one, in his senses, will doubt; but that they owe this property to the presence of oxygen, is entirely erroneous.

What is meant by oxygen in a concrete state, I am at a loss to imagine; as this gas has never been solidified, either by cold or pressure. If it be hereby implied, that the oxygen, whilst in combination, retains the properties which it possessed in its pure state, and the power of exerting them, the supposition is entirely erroneous. For instance; nitric acid, one of the most active 'canteries known, and ammonia which possesses considerable energy as a cautery, combine forming nitrate of ammonia, which is no more of a cautery than chalk.

The vast difference between mere mechanical mixture and chemical combination, must always be borne in mind. In the former, the mixed bodies remain unaltered, each retaining its respective properties; in the latter, a total transformation is undergone.

Chalk and water, though *mixed* ever so minutely, will never combine; and, being left without disturbance, will separate, arranging themselves according to their respective gravities. Whereas, if muriatic acid, for instance, had supplied the place of the water, muriate of lime would have been formed; which everybody knows, possessess neither the properties of the muriatic acid, nor of the chalk.

Your's very truly,
J. B——LL.

Atmospheric Electricity.—On Tuesday week Mr. Andrew Crosse delivered a lecture on atmospheric electricity at Taunton, illustrated by a number of beautiful experiments. He illuminated 400 feet of iron chain, hung in festoons about the room, the whole extent being brilliantly lighted at the same instant by the passage through it of the spark from the battery; and melted several feet of wire. Mr. Crosse afterwards detailed the results of many experiments on thunder clouds and mists. By means of a wire apparatus suspended in his park, he had discovered that a driving fog sweeps in masses, alternately negatively and positively electrified; and once the accumulation of the electric fluid in a fog was so great, that there was an incessant stream from his conductor of sparks, each one of which would have struck an elephant dead in an instant.—*Times.*

Effect of Oxygen on Glow-worms—It is an interesting experiment, to place a glow-worm within a jar of oxygen gas in a dark room. The insect will shine with much greater brilliancy than it does in atmospheric air. As the luminous appearance depends on the will of the animal, this experiment probably affords an instance of the stimulus which this gas gives to the animal system.

Magnesia and Oil.—Calcined magnesia has the property, if rancid oil be heated with a quantity of it, completely to destroy the rancidity of the oil.

To Cast Figures in Imitation of Ivory.—Make isinglass and strong brandy into a paste with powder of egg shells finely ground; you may make it what colour you please: but cast warm water into your mould, which should first be oiled over. Leave the figure in the mould to dry; and, on taking it out, you will find that it bears a strong resemblance to ivory.

To Soften Iron or Steel.—Any of the following simple methods will make iron as soft as lead.—1st. Anoint it all over with tallow, temper it in a gentle charcoal fire, and let it cool of itself. 2nd. Take a little clay, cover your iron with it, temper in a gentle charcoal fire. 3rd. When the iron is red hot, strew hellebore on it. 4th. Quench the iron or steel in the juice or water of beans.

Annealing.—A process somewhat analogous in principle to tempering metals. Its object is to render substances, otherwise brittle, tough; and it is usually performed by cooling them gradually after they have been heated.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, April 3. Dr. Truman, on Comparative Physiology. Friday, April 5, J. M. Leigh, Esq , on Eloquence. At half past Eight o'clock precisely.

St. Pancras Literary and Scientific Institution Colosseum House, New-road. — Tuesday, April 2, P. E. Dove, Esq., on the Structure and Functions of the Teeth. At half-past Eight.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, April 4, John King, Esq., on the Cartoons of Raphael. At half-past Eight.

Poplar Institution, East India Road. — Tuesday, April 2, Dr. Carpue, on Anatomy and Physiology. Friday, April 5, Discussion, on Marriages.

Greenwich Society, 15, Nelson Street, Greenwich.—Tuesday, April 2, Half-yearly Meeting. At eight precisely.

Islington and Pentonville Philo-Scientific Society. Prospect House, White-lion-street.—Thursday, April 4, Discussion, on Temperance Societies. At Eight o'clock.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—I understand Mr. Merryweather, of Broad-court, Long-acre, has one of the simplest and best velocipedes; can any of your correspondents give me any idea of the dimensions of it, as I am about making one. Z. X.

Regent's Park.

Sir,—I should feel much obliged if you or any of your correspondents could inform me of what the black composition musical boxes is made of, and how I may repair one that is much chipped? C. H.

Sir,—I should feel obliged if you or any of your numerous correspondents can inform me the process of varnishing plaster figures, and what kind it is that will bear washing when soiled, and not spoil the delicate white appearance they have when taken from the mould? I am aware of the wax-and-soap process, but it will not answer, and the metallic preparation I find in No. 106, is tedious, and not given explicitly. Lately I have seen some phrenological heads beautifully white, having the appearance of enamel, and, I understand, will bear washing without injury. W. C. W.

Limehouse.

Sir,—Allow me to ask, through your good work, if there has yet been a steam-plough invented? Such a thing would be a grand object to attain in agricultural mechanics. Also, the way to build warm and waterproof cottages without wood, bricks, or stone? —How to make the Congreve matches; and yeast?—The plan, proportions, and probable cost of a steam-engine of about one and a half horse-power, to be applied to thrashing, grinding, vertical, and circular sawing, turning, &c.—How to make a cheap barometer, a thermometer, and sachrometer, with plain calculations for the latter?—A cheap still and the best apparatus yet known for making charcoal?—Also, the smallest and lightest portable camp and bedstead, and other utensils suitable.

An Adopted American.

ANSWERS TO QUERIES.

Sir,—I beg to inform " A Subscriber," that Mr. Hancock s factory was, and I believe still is, at Stratford, in Essex.

" N R." *Preparation of Acetic Ether*, extracted from Dr. Ure's Dictionary.—" Acetic ether may be economically made with three parts of acetate of potash, three of very strong alcohol, and two of strongest sulphuric acid, distilled together. The first product must be re-distilled along with one-fifth of its weight of sulphuric acid. As much ether will be obtained as there was alcohol employed." E. L. F.

" T. S. F." may make an electrical air-cannon with a glass tube, by closing one end and inserting two brass wires in holes drilled in opposite sides of the tube. The wires must not meet inside, but be distinct from each other about one-eighth of an inch, the under one to be in connection with the earth, and the other provided with a brass knob, to receive the electricity from the machine.

" A. B." A four-way cock may, perhaps, answer the purpose.

" C. C." Copper wire covered with cotton or silk, may be purchased at " Fairburn's, opposite St. Luke's church, at a moderate price.

" G. H. G. ' Try a strong solution of pearl-ash or soda

" W. P." Cloth seams are sometimes stuck together with India-rubber solution, spread over the parts intended to be put together, and about half dried before closing. The solution is made according to receipts given in Nos. 16 and 121.

" An Amateur Bookbinder may procure any sort of leather or embossed cotton at 10, Little Newport-street, Soho Mill-boards may be procured at Limbird's, 143, Strand.

" Electron." To find the diameter of a circle is fully explained in No. 94. W. P. C.

Purple Fire.—I have analysed some of this, which I purchased at a shop in Fetter-lane: its composition was, three parts sulphur, and one chlorate of potass; but if any of your Correspondents can inform me of a better, or where I can purchase some, they will much oblige. ELECTRON.

TO CORRESPONDENTS.

The whole of the queries sent by G. J H. *have been answered in our back Numbers He should purchase the three volumes the information contained in which he would find of invaluable benefit to him.*

J. B.—*A solution of common salt may be substituted for muriatic ether, in the preparation of the paper for the Daguerreotype. This is Mr Talbot's invention. Like all others hitherto published, the light and shade are reversed; the dark parts being represented in white, and the white, or illuminated parts of the object, being black in the picture. The solution of nitrate of silver should not be too strong; one part of sarated solution to twelve parts of water is sufficient.*

R. Bates.—*When we speak of degrees of heat in England, the scale of Fahrenheit is always referred to: in France, Reaumur, or the centrigrade, but the latter is not understood, unless it be expressly mentioned. De Lisle is seldom used except in Russia. It is easy to reduce the degrees of one scale to any other, the points of freezing and boiling being given; they are as follows:—Fahrenheit, freezing point* 32, *boiling point* 212: *Reaumur, freezing point* 0, *boiling point* 80; *Centigrade, freezing point* 0, *boiling point* 100; *De Lisle, freezing point* 150, *boiling* 0.

Aleph.—*The blue appearance of deep clear water, has often attracted the attention of philosophers, but its cause remains unknown. Various colours are observed in different seas, which are found to proceed from animal, vegetable, or mineral matter suspended in the water; but the blue tint of clear water cannot at present be accounted for either by chemical or optical researches.*

W. H. P., *with several others who have made similar inquiries, is again informed, that the* Title, Index, *and Frontispiece, to Vol. III. of the Mechanic*, has been published some weeks, *and is to be obtained of our Publisher.*

London: Printed at " THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY; and published every Saturday, by G. BERGER, Holywell-street, Strand: and may be had of all Booksellers and Newsmen in Town and Country.

THE

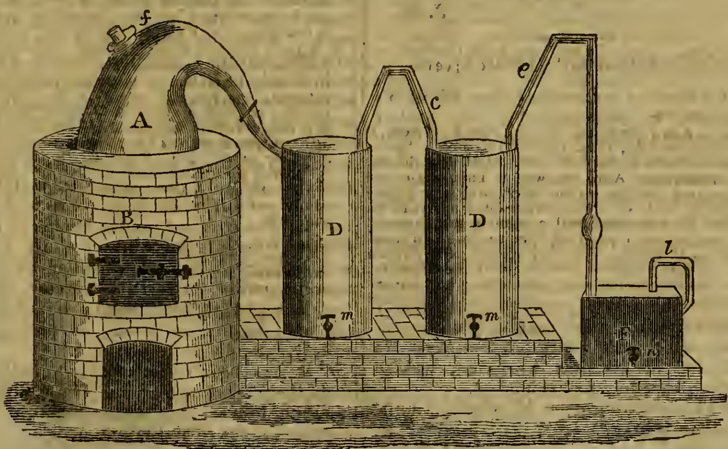
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XV. NEW SERIES.	SATURDAY, APRIL 6, 1839. (PRICE ONE PENNY.)	No. CXXXVI. OLD SERIES.

RAYS OF LIGHT IN WATER.

APPARATUS FOR MANUFACTURING NITRIC ACID.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

RAYS OF LIGHT IN WATER.

To the Editor of the Mechanic and Chemist.

SIR,—Having seen an article in your last Number, "Rays of Light in Water," I beg to offer a few words on the same subject, but under different circumstances.

During clear weather and bright sunshine, while sailing on the Atlantic ocean, far from land, that wherever the shadow of my head appeared on the surface of the sea, it was invariably surrounded by innumerable radiating lines of light, in form of the sketch, which is intended to represent the shadow and the radii which circumscribed it.

I never heard any other person make the same remark, either before or since I first noticed the phenomenon many years ago, neither have I ever read any account of it.

It appears to result from the saline particles of the ocean, otherwise the same effect would be produced from the fresh water; and it has nothing to do with any undulations of the surface, but appears to be reflected from some depth by the pervading solar rays.

The height of the eye from the surface of the water might have been about 20 feet, and the obliquity of the shadow might make the distance about 25 feet, or more. The outer circumference of the radiating lines, was, to the best of my recollection, about four feet in diameter, so that the visual angle was but small. These few particulars may serve to elicit the scientific opinions of the gentleman who favoured us with the able article alluded to.

I remain yours, &c.

J. B.

KNOWLEDGE OF MECHANICS.

THE following is extracted from Claxton's "Hints to Mechanics." The author quotes from a former number of the "Mechanic and Chemist," an anecdote of a manufacturer who received an order for five hundred pounds worth of dolls' eyes, which he was unable to execute, not knowing the proper method of making them; and after wasting much time in experiments the project was abandoned. After a while, he met a poor fellow in poverty from drinking, who taught him the secret; and the difference between his mode and that of his own workmen, was so trifling, that he was astonished.

"Five hundred pounds' worth of dolls' eyes in one order!—that is no "trifle," at any rate. And the difference between the right way and the wrong so little, yet that was no trifle neither. It made all the difference; and so it does between us and the French. Nor is it in such things as trinkets, and jewels, and millinery alone, though the gross amount of even these things, and the like, which France exports, is immense. It is, as I said above, wherever design and taste come into play. Dr. Bowring stated, for example, before the Committee of the House of Commons on this subject, that, 'of the silk manufactures of France, five-sixths of her whole productions are exported; of the silk manufactures of England, probably not more than one-eighth or one-tenth is sent to foreign countries. The reason is found in the superior excellence of the French patterns. So in the cotton manufacture; for in those departments of France, — Alsace, for example, —where the arts are most advanced, they are, notwithstanding the higher price of the raw material, notwithstanding the imperfection of their machinery, the absence of sufficient capital, and the heavy local taxation,—able to export those cotton manufactures which are recommended by beautiful patterns, or are in any way connected with the application of the fine arts to manufactures.'

"And so it is in the great department of architecture, and in many other things. The secret of this superiority I have alluded to. It is in schools, models, study, pains. And see how general is the effect; how the whole character of the common people even, as well as the mechanics, becomes impressed with this taste and science; so that, in fact, the *market* for well-made things increases as fast as the manufacture itself. Dr. Bowring again says, "Even the dwellings of the people are not built upon a uniform model. Their churches have in them beautiful paintings, admirable sculpture, fine music,—in a word, all the arts are made subservient to religious services. The common beds and furniture of their houses are much more graceful than in this country, and frequently exhibit much tastefulness and variety. The costume of the people in different parts of the country must have struck every observant traveller as presenting, amidst its varied character, such frequent and striking specimens of simple and ornamental dress, as portray a widely-extended taste and tact.'

"It has been remarked, that, judging from these specimens, 'one might almost imagine, indeed, that, independent of the refinement of eye and fancy, which constitutes taste, the French were endowed with that peculiar organization, that fineness

and lightness of touch, which enable the Hindoos to produce finer muslins than can possibly be compassed by European weaving.' But we see no proof of anything of the sort, and there are proofs enough to the contrary in all those great branches of manufactures and mechanics, wherein the English have really done justice to themselves. And it is the same thing with the Swiss. Nobody ever heard that *they* were peculiarly endowed by nature over us or over the French; and yet in some matters they beat us both. Hear the Doctor once more:—'Switzerland is at this moment the seat of the most extensive production of delicate mechanical works. In the Jura mountains, in the French part of the canton of Berne, and at Geneva, almost all the watches, musical boxes, &c., which supply the continent of Europe, and the western and oriental world, are manufactured; and the extent to which the knowledge of the mechanical arts is diffused among that population, whose habits are partly agricultural and partly manufacturing, but altogether domestic, is very striking. I imagine that the average rate of wages for manufacturing labour in these districts, is higher than in any part of the European world; and the effect of their great knowledge, industry, and aptitude, has been such, that more than half the population have become proprietors of land. A man can scarcely be found who is not able to read and write, and who is not a practical master of that mechanical art with which his trade is particularly connected; and yet I found amongst all those watch-makers one of the best evidences of knowledge,—namely, a wish to know more, the expression of a great desire that further means should be taken to communicate instruction in yet higher branches of art and science.'

"And now behold the effect of all this: 'I found the Jura mountains had been lately visited by a Chinese, who had studied there three years among the watch-makers, in order that he might set up trade in China. Such is their superiority, that they carry on a large trade with the remotest regions; and I believe that superiority to be mainly due to the great diffusion among them of the practical science of mechanics. I think there are eight or nine professors in the Ecole Industrielle of Geneva; but there is also a special school of watch-making, for the instruction of those who mean to pursue that particular branch of industry. In the school at Geneva, five francs are paid for the first year, and ten for the second and third, and the deficit is made up by the government funds.' This is enough for a specimen of how foreigners can beat us if we let them, just as among us one mechanic will beat another in the same trade, on the same principles. Who can wonder at it? How can ignorance compete with knowledge—negligence with attention—and a person in want of practice and skill with a person possessed of both?"

UNIFORM PENNY POSTAGE.

It is in contemplation, when other measures of less general utility are disposed of, to bring this important question again before our legislature. This great project was first conceived and published in a pamphlet by Mr. Rowland Hill, and has since been minutely investigated by a select Committee of the House of Commons. It is scarcely necessary to dwell upon the manifest benefit which the adoption of this measure would confer upon every class of society; the labouring man who wanders from town to town in search of employment, would be enabled, by means of correspondence, to ascertain in what direction he could travel with the fairest chance of success; parents and children, friends and comrades, would no longer be denied the consolation of that mutual confidence, and mental intercourse, which strengthens the most sacred ties of affection and friendship; even peers of the realm, and other privileged persons, would, without incurring any considerable expence, be relieved from the painful duty of depriving the revenue of about three hundred thousand pounds a year. It is gratifying to find that these advantages are fully appreciated and set forth by the Committe. Their third report commences with this powerful remark:—"Your Committee have entered upon the inquiry which has been intrusted to them, with the deepest sense of its vast importance to the public; since on the management of the Post Office, and the regulation of the postage rates, depends, in a great measure, the entire correspondence of the country; and in that correspondence is involved whatever affects interests, or agitates mankind: private interests, public interests; family, kindred, friends; commercial business, professional business; literature, science, art, law, politics, education, morals, religion. Every rank and class has an interest—more or less immediate—in the safe, speedy, and economical transmission, of Post Office communications." The plan proposed by Mr. Hill is, that stamped covers should be issued by the Stamp Office, at the charge of one penny,

within which, letters of a limited weight should be conveyed to any part of the kingdom without any further charge. The Committee, after a most laborious investigation, having sat 63 days, and examined nearly a hundred witnesses, have arrived at the conclusion, that the project is practicable without injury to the revenue. They nevertheless suggest, that a uniform charge of twopence for all places above fifteen miles distant from the place of departure, and one penny for all places within that distance should first be tried, in order to ascertain the effect which it would produce on the revenue.

The number of letters and newspapers yearly distributed by the Post Office, is now estimated at 126,423,836, of which 7,000,000 are franks. The increase anticipated by the adoption of the plan proposed by the Committee, would make the yearly number 304,695,540, including the 7,000,000 which are now franked, but which would be charged in the new system. The existing yearly revenue is 2,374,923*l.*; the anticipated revenue is 2,455,808*l.* The average rate per letter is now 7·6074 d., or rather more than $7\frac{1}{2}$*d.*; the anticipated average rate is 2·3277 d., a little more than $2\frac{1}{2}$*d.* The uniform charge of 2*d.* applies only to single letters weighing under half an ounce; an additional penny is to be charged for every half ounce above that weight. The present postage rates for single letters throughout Great Britain, are as follows:—

	Miles.	Rates. *s.*	*d.*
From any post-office not exceeding	8	0	2
Ditto	15	0	4
Ditto	20	0	5
Ditto	30	0	6
Ditto	50	0	7
Ditto	80	0	8
Ditto	120	0	9
Ditto	170	0	10
Ditto	230	0	11
Ditto	300	1	0
Ditto	400	1	1
Ditto	500	1	2

For every additional 100 miles, or part thereof, 1*d.*

Owing to the high charges of the Post Office, an immense number of letters are sent all over the country by illicit means; it is unlawful for carriers to convey letters in parcels; and in some cases, both carrier and writer have been held amenable to the law. There are, however, ways of avoiding this obnoxious tax, *without a breach of the law*; any old stamped newspaper may be sent free to any part of the kingdom, and signals may be agreed upon, such as a peculiar manner of folding it, or convertional characters in the address, &c.; but the best and safest of all, is to send a blank letter, with a previous understanding that the address shall convey the required intelligence; the person to whom the letter is addressed, has a right to examine the address, and afterwards refuse to pay the postage, leaving it in possession of the Post Office, from whence it would be returned to the writer, did it contain his address, and he would be compelled to pay. Between three and four hundred petitions have already been presented to Parliament, praying for the abolition of the letter tax; others are still pouring into both houses, and they are ordered to "lie on the table," which means that they are to be stuffed into a bag, and safely deposited where they will never again see day-light, till posterity shall "wonder such relics there should be." It is not by petitioning, that selfish legislators will be brought to a sense of their duty; another course must be taken —*avoid the payment of postage whenever it is possible without a breach of the law.* Writing on the margin of a newspaper with invisible ink is unlawful, therefore we do not recommend its adoption; but there are, probably, consciences callous enough to bear the reflection of such a crime without compunction or remorse.

W. M.

DAGUERROTYPE.

M. Arago has communicated to the French Academy, facts which appear to decide, in a positive manner, the validity of M. Daguerre's claim to the priority of invention which has been contested by Mr. Talbot. M. Bauer, of Kew-green, inserted in the *Literary Gazette* of the 2nd of March, an article detailing the history of the discovery in question. In 1827, M. Niepce, at the request of M. Bauer himself, addressed to the Royal Society of London, a memoir entitled "Heliography," with specimens in support of his assertions. This memoir was not published, because the process was not described. It was withdrawn, and Mr. Bauer has published it as it was in the original. This important communication establishes the right of Mr. Niepce relative to English artists. As for the claims of M. Daguerre and M. Niepce regarding their respective rights, M. Arago announces that they are defined and limited by a legal act; and in this document, the name given to the instrument, and which will probably be universally adopted, is *Daguerrotype.*

THE ÆLLOPODES.

A MACHINE so called, has been exhibited at the George Hall, Aldermanbury. It is a carriage moved by the traveller's own weight, by stepping upon two treddles or levers, which, by means of a crank, communicate the power to the wheels. There are two wheels, about six feet in diameter, and one smaller one in front, which serves to guide the carriage. The inventor, Mr. Revis, of Cambridge, recommends it as a healthy exercise; the action of the feet is almost identically the same as in the tread-mills, where offenders expiate their guilt or poverty. Power may certainly be obtained by this means, with much less fatigue than could be done with the hands; but it is doubtful whether a light person would be able to exert sufficient power to ascend the steep hills which occur in many of our roads; in order to do this, the weight of the traveller multiplied by the distance of the treddle's descent, must be greater than the aggregate weight of the carriage and traveller, multiplied by the height of the inclined plane, its length being equal to half the circumference of the motive wheels. The inventor also says, that this machine may be propelled at the rate of from twenty to thirty miles an hour on common level roads; but we fear the rapid motion of the feet which would be required to sustain so great a speed, would be found too distressing to be continued long together.

EARTHQUAKES.

NOTWITHSTANDING the researches of philosophers of all ages, the cause of these terrible visitations remains unknown. The following curious details of the earthquake which a short time ago desolated the island of Martinique, are taken from a note addressed to the French Academy by M. Moreau de Jonnès. The unusual circumstances attending this earthquake, seem to contradict the opinion generally entertained, that subterraneous volcanos having no issue, are the cause of those destructive convulsions which have so often buried man in the ruins of his mightiest works.

The first circumstance pointed out by M. Moreau as worthy of remark, is the occurrence of the phenomenon in the unusual season, the month of January; also the sky, which is usually clear at that season, was then covered with clouds, and the whole island was enveloped in vapours; a strong north-west wind was observed, which was before unknown at that period of the year; the earthquake consisted of two violent shocks of thirty seconds' duration; they appeared undulatory, and proceeded from the south to the north. The existence of subterraneous noises, which, it has been stated, were heard, does not appear to be proved; *M. Moreau, who has witnessed forty earthquakes, never heard those noises.* An iron grating, newly placed in front of the hospital, was torn away from the stones to which it was attached, and thrown a considerable distance. Upon the relation of this extraordinary fact, M. Arago reminded the Academy, that M. Gay had upon a former occasion, communicated to the Academy an equally surprising occurrence; a mast, planted in the ground, was thrown up into the air during an earthquake.

The oscillations were not confined to Martinique; they were felt along the whole chain of islands, whose extreme points are above six hundred miles distant. The shock which destroyed Fort Royal, extended more than sixty miles, and out of the chain, across the water of the ocean. In a ship at sea, it was perceived several hours before the high mountains were discovered. The depth of the water at that place is commensurable. M. Pacini, ensign on board the French corvette, *La Recherche*, says in a letter which has also been transmitted to the French Academy,—At six o'clock in the morning, the ship was shaken by the shock, which lasted about forty seconds; the top-masts bent, and waved like bamboos. Some seconds after, M. Pacini saw rising upon the shore a kind of vapour, which escaped from crevices in the ground; but in a short time the falling of houses caused such clouds of dust, that the land could not be seen during several minutes.

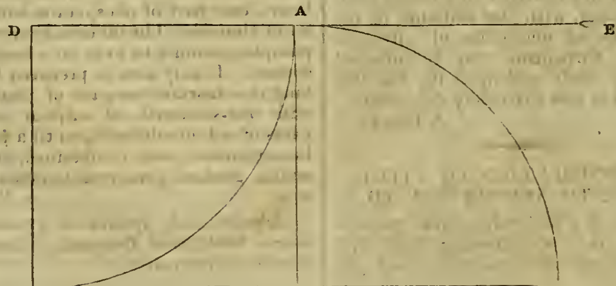
Photogenic Drawing—has become an important art. Mr. J. F. Havell, and Mr. Willmore, have, by covering glass with etching ground and smoke, sketched designs upon it. Through the glass thus exposed by the scratches, the photogenic paper receives the light; and the design, which the sun may be said to print, may be multiplied with perfect identity for ever! Designs thus produced will probably become much more common, and even more generally applicable than lithography, because all the means are more readily accessible, whilst it will receive its rank as an art, and be excellent in proportion to the skill of the artist, as a draughtsman with the etching-needle. The size need no longer be kept down by that of the printing press, as the size of the glass can alone limit the size of the design. This

is a real and valuable discovery, applicable to a thousand purposes. It is reported that Mr. Havell, and his brother, the well-known painters, have succeeded in giving some true colours, also, to their productions, by the action of light. Beautiful imitations of washed bistre drawings may be produced, by stopping out the light on the glass by black varnish, which will obstruct the transmission of light in proportion to the thickness with which the varnish is laid on; and specimens, like fine mezzotinto prints, have been produced by this process.—*Literary Gazette.*

Celebrated Oaks.—The oldest oak in England is supposed to be the Parliament Oak (so called from the tradition of Edward I. holding a Parliament under its branches), in Clipstone Park, belonging to the Duke of Portland, this park being also the most ancient in the island: it was a park before the conquest, and was seized as such by the Conqueror. The tree is supposed to be 1,500 years old. The tallest oak in England was the property of the same nobleman; it was called the "Duke's Walking-stick," was higher than Westminster Abbey, and stood till of late years. The largest oak in England is called the Calthorpe Oak, Yorkshire; it measures 78 feet in circumference where the trunk meets the ground. The "Three-Shire Oak," at Worksop, was so called from covering parts of the counties of York, Nottingham, and Derby. It had the greatest expanse of any recorded in this island, dropping over 777 square yards. The most productive oak was that of Gelonos, in Monmouthshire, felled in 1810. Its bark brought 200*l.*, and its timber 670*l.* In the mansion of Tredegar-park, Monmouthshire, there is said to be a room 42 feet long and 27 feet broad, the floor and wainscoat of which were the produce of a single oak tree grown on the estate.

New Method of Harpooning Whales.—On Friday afternoon week, one of the boats belonging to the Grenville Bay whaling vessel of this port, was manned under the direction of Captain Taylor, and proceeded to the Narrows to make experiments with some guns which have been constructed by Mr. W. Greener, of this town, for the purpose of harpooning whales. The difficulty that has of late years attended the Davis' Straits fishing, has induced the spirited proprietors of the vessels in that trade belonging to the port of Newcastle, in order to give greater certainty to the expedition, to fit each vessel with one or more guns for projecting the harpoon, and securing the fish at a distance which it would be entirely impossible to accomplish by muscular exertion. The result of the experiments of Friday week was such, as to put beyond doubt the practicability and utility of the plan, as the harpoon, of upwards of twelve pounds' weight, can be projected with certainty a distance of forty yards, having a three-quarter inch rope attached; consequently a fish may thus be secured when it would be impossible to strike it with the hand, or in case of a race between the boats of different ships, the gun-boats would stand by far the best chance to secure the prize, by reason of their being able to project the harpoon to a much greater distance. The guns are neatly executed with percussion locks.—*Tyne Mercury.*

PROBLEM.



A B D and A C F are two equal quadrants inscribed between the parallels B C, E D, in such a manner that the point of intersection between the tangents of the one shall be the centre of the other quadrant. It is required to bisect the figure A B C by a right line drawn from the point A through the line B C. A. Z.

MANUFACTURE OF NITRIC ACID.

(See Engraving front page.)

Nitric acid, for commerce, is procured by distilling nitre with strong sulphuric acid. The engraving in the front page is a representation of the apparatus employed in this process. A is a large iron pot with earthenware head and plug at I: two iron vessels receive the acid, and are provided with earthenware stop-cocks. The iron vessels are united by the pipes C E, and a third vessel containing a safety pipe L, dipping in water, completes the apparatus. In this state it is called *hydro-nitric acid*, a term denoting its combination with water; when entering into other compounds, it abandons the water, and combines in a dry state, which is distinguished by the term *anhydrous* (without water). This acid may be readily produced by passing the deut-oxide of nitrogen very slowly into oxygen gas, standing over water. By this operation four volumes of the former combine with three of the latter: the compound consists of two volumes nitrogen, and five volumes oxygen. It is an intensely acid liquid, which, when pure, is colourless; and when most concentrated, has a specific gravity of 1·5; consequently a given volume of acid will weigh as much as one and a-half times its volume of water; or two pints of acid equal in weight, three pints of water. In this state it contains 25 per cent. of water; which is the least quantity with which it is known to exist; but it may be mixed with water in any proportions beyond the 25 per cent.

Nitric acid is a highly corrosive fluid, and acts as a powerful cautery when applied to the skin, which it stains of a permanent yellow. It is decomposed, with great violence, by most substances which have an affinity for oxygen, which element enters so largely into its composition. If it be brought into contact with hydrogen at a high temperature, a violent detonation will be the consequence; but the experiment is dangerous. When poured upon warm dry charcoal in powder, combustion ensues, with the emission of copious fumes of dentoxide of nitrogen. Spirits of turpentine may be inflamed by pouring nitric acid upon it; but this experiment is also extremely dangerous.

J. Banks.

TRANSFORMATION OF CITRIC ACID INTO ACONITIC ACID.

M. Berzelius has endeavoured to establish by various experiments, that citric acid combined with water, or with the bases, undergoes, at a certain temperature, a metamorphose, from which arises a chemical combination of two atoms of citric acid, and one atom of aconitic acid. In the *citro-aconitates*, water regenerates citric acid, in uniting itself with the aconitic acid; but in the double hydrated acid, this last metamorphose does not take place.

At the temperature of 180°, citrate of soda becomes citro-aconitate; water will cause it to resume the state of ordinary citrate of soda; but by means of alcohol from 0·80 to 0·82, the aconitate is isolated from the citrate.

Citrate of silver, metamorphosed and placed in contact with alcohol mixed with very strong hydrochloric acid, in a quantity insufficient to decompose the whole of the salt, furnishes a residue, by the evaporation of the alcohol; and in this residue the aconitic acid reappears.

Lastly, if the acid extracted from the metamorphosed citrate be saturated with carbonate of soda, the citrate is crystallized by spontaneous evaporation, and the aconitate, which is more soluble, is contained in the water, and may be isolated by means of alcohol of 0·833.

There are two citrates of silver; one is formed at the instant of precipitation, the other is produced from it rapidly at a temperature of 60°, but slowly at an ordinary temperature. It then assumes the aspect of a heavy crystalline powder, the crystals of which are often visible to the naked eye. The first citrate may be obtained, if not without any change, at least with very little alteration, by washing it rapidly in cold water, and filtering through blotting-paper, and drying in a good vacuum; this salt will then give out water at a heat of 60° to 100°. The scale here referred to, is the *centigrade*.

To make Liquid Phosphorus.—The best method of preparing liquid phosphorus is as follows:—Heat very gently, for two hours, one part of phosphorus with six of oil of almonds. The oil thus charged with phosphorus must be kept in a bottle, well corked. It may also be prepared by rubbing in a mortar one part of phosphorus with one-sixteenth of sulphur and ten parts of oil of almonds, until a perfectly homogeneous mass is obtained, and then adding gradually more oil to effect a solution.

W. M.

Ashydrite.—A species of gypsum, the *marmo bordiglio* di Bergamo of statuaries; it takes a fine polish.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, April 10, Dr. Truman, on Comparative Physiology. Friday, April 5, J. M. Leigh, Esq., on Eloquence, in conclusion. At half past Eight o'clock precisely.

St. Pancras Literary and Scientific Institution Colosseum House, New-road. — Tuesday, April 9, P. E. Dove, Esq., on the Diseases and Management of the Teeth. At half-past Eight.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, April 11, Timothy Claxton, Esq., on Mechanics. At half-past Eight.

Poplar Institution, East India Road. — Tuesday, April 9, Mr. Stephenson, on Life Assurance. Friday, April 12, Discussion, on Novel Reading.

Islington and Pentonville Philo-Scientific Society, Prospect House, White-lion-street, - Thursday, April 4, Nathaniel Rogers. M. D., on the Mythology of the Ancients. At Eight o'clock.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—I should feel obliged if you or any of your readers would answer the following queries as early as possible :—If I have an engine made on Brahma's principle. the small cylinder of which is seven feet in length, and one inch in diameter, and the larger cylinder 15 inches in diameter; when the piston in the small cylinder is depressed the extreme length of the cylinder, how much will the piston rise in the large cylinder ? Or supposing the small cylinder six feet in length, and one inch in diameter, and the larger cylinder twelve inches in diameter, would it raise the piston in the larger cylinder sufficiently to turn a crank with fly-wheel attached ? And likewise what power would be gained, the pressure on the small piston being one hundred weight ? T. N.

[The power of the larger piston is to that of the lesser, as the squares of their diameters ; its elevation is inversely as the squares of the diameters.—Ed.]

Sir,—I have in my possession a few trifling articles composed of very fine copper wire, and having seen some of the same sort coloured to a beautiful gold colour, if through the medium of your useful publication, you would forward me any information how to accomplish the same, you will confer a favour on

A Country Reader.

N B. Perhaps you would be kind enough to inform me which sort of wire is the best for taking the colour of gold, and the process of blacking iron wire in imitation of the Berlin iron wire ?

Sir,—Will you have the goodness, through the medium of your useful publication, to inform me of the best means of preparing water colours ?

A Constant Reader.

Sir,—I should feel obliged if you or any of your correspondents will inform me the way in which the "Papier Maché' is prepared, I mean that which they make the figures, and also how they bronze them ?

F. L. A. W.

Sir,—Can you or any of your correspondents inform me how to make French polish to clean ladies' shoes with, to be laid on with a sponge ? J. P.

Lancaster, March 21.

ANSWERS TO QUERIES.

"A Beginner" in No. 10. may fasten the caps on his electrical cylinder, by having them turned so as to fit easily over the ends of it, and fill ng the intervening space with the following cement :—Rosin, 5 oz. ; bees-wax, 1 oz ; red ochre, 1 oz. Baked wood is of no consequence for the pillars of the machine ; a piece of dry mahogany, I think answers as well as any. The best work I have seen, is "Singer's Elements of Electricity ;" but if experiment is all he wishes for, he will find a great many in my papers on this subject. Electron.

"Ebles, No. 131. To find the tonnage of a vessel, multiply the length of the keel, taken within board, by the breadth of the sihp within board, taken from the midship beam, from plank to plank, and the product by the depth of the hold, taken from the plank below the keelson, to the under part of the upper deck plank, and divide the last product by 94, and the quotient will be the tonnage required. A. D. M.

Sir,—In answer to the inquiries of an "Adopted American," in No. 14 of the "Mechanic and Chemist," I beg to inform him that he may be furnished with a steam-engine suitable for all the purposes mentioned, viz., thrashing, grinding, vertical and circular sawing, turning, &c. The above engine will amount to 4 or 5-horse power, the price of which is 130*l*. A 1-horse power is quite incapable of performing the above work ; the engine is now employed for the above purposes, and may be seen by applying to Charles Coxel, Clap-gate, Bowling-green-walk, Worcester. I have also a vertical saw frame, with 12 saws, complete, for sawing deals, which I should have no objection to dispose of.

Sir,—I beg to inform "X. Z.," Regent's Park, that a friend of mine has purchased the velocipede he mentions ; it is for sale, and he can have further particulars by applying by letter only (post paid), to A. R., 25, Sun-street, Bishopsgate-street.

A R.

TO CORRESPONDENTS.

S. B. G.—*The acid used for etching copper plates, is diluted nitric acid ; the varnish is recommended to be composed of gum mastic, bees' wax, and asphaltum ; the varnish is blackened by the smoke of a lamp, after the varnish is equally laid on by heating the plate. The same operation may be performed with steel, but many difficulties will be met with in every process, and they can only be overcome by perseverance and study.*

D. B.—*The question respecting lunacy is fitter for a medical work than the "Mechanic." The enlightened editor of the Lancet, would, we venture to predict, tell our correspondent, that the notion of madmen being affected by the full moon, is a remnant of astrological error. In many diseases, periodical variations occur, and, in some particular instances, the interval may be about the time of the moon's rotation ; but that any mysterious or occult influence is exercised by that or any other planet on the human mind, is contradicted by experience, and denied by modern science.*

A Mechanic.—*If he will explain what he means by "non-conductors of magnetism," his communication will become intelligible, and shall be either inserted or answered. No substance will intercept the polar tendency, or the metallic attraction of a magnet ; they may be overcome by contrary action, but no substance, at present known, will in any degree diminish the intensity of simple magnetic power, by being placed between the magnet and the point towards which it inclines.*

A. B.—*There was no signature to our Correspondent's letter, but he will perceive, by the subject, that we are addressing him. If he will send us a description of his plan for protecting water-gilders from the pernicious effects of mercury, we shall feel pleasure in publishing it, if we consider it of any utility.*

A Constant Subscriber.—*We will make the necessary enquiries to obtain the information he requires.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); and published every Saturday, by G. Berger, Holywell-street. Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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PICTURES FORMED BY THE ACTION OF LIGHT.

Fig. 1.

Fig. 2.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PICTURES FORMED BY THE ACTION OF LIGHT.

To the Editor of the Mechanic and Chemist.

(See engraving, front page.)

Sir,—I have watched, with the greatest interest, the development of the secrets of photogenic drawing, and I feel it a duty to say, that I have found the earliest and best information in your publication. All the processes which have hitherto been described, both those communicated to the French Academy by MM. Biot and Arago, and that published by Mr. Talbot, which is only a modification of the early productions of M. Daguerre, produce reversed pictures; i. e. the white and illuminated parts become black in the picture, and *vice versa:* as represented in fig. 1, which was taken with the sun behind, forming a strong contrast of light and shade; the preparation not being sensible enough to show the intermediate shades distinctly. The object of my present communication is, to suggest a method of transforming such pictures into true representations of nature; as exhibited in fig. 2. Paper prepared with muriatic ether, or other substances, and afterwards immersed in nitrate of silver, as described in former numbers of your magazine, is impressionable by the action of light, which turns it black. Now having produced a picture, fig. 1, on thin, transparent paper, by applying that picture to another prepared paper, and exposing them to the action of the sun; the white parts will be acted upon by the light transmitted through the transparent parts of the picture, and the parts corresponding with the black, will remain unaltered; the light being intercepted by the dark parts of the picture: the whole effect is thus reversed, and a natural picture is obtained; as represented in fig. 2. I merely propose this experiment, as one of temporary interest; when M. Daguerre's marvellous discoveries are revealed, all other attempts will soon be disregarded and forgotten.

Q. F. D.

POSTHUMOUS OPERA OF MOZART.

The admirers of Mozart (that is, the whole musical world,) will soon be gratified with an entire opera of this great *Maestro*, which has never before been published. The following is written from Darmstadt, March 26:—"The posthumous opera of Mozart, *Zaidie*, the publication of which has been so impatiently expected, has just appeared in the orchester score, and Pianoforte arrangement,' published by Jean André, at Offenbach. In the two scores is a *fac simile* of the writing of Mozart. The libretto of this opera being lost, M. André employed a young poet of our town, M. Charles Gollmick, to fill up the vacancies between the airs by a dialogue. This task was very difficult; on the one hand, because the lyric part very imperfectly indicated the progress of the action, and on the other, because it results from the principal pieces which are accompanied with the words, that the fable of *Zaide* must bear a great resemblance to that of another opera of Mozart, *L'Enlèvement du Serail.* Notwithstanding these difficulties, M. Gollmick has satisfactorily acquitted himself; his libretto, which is now printed in our town, has created great interest. The opera of *Zaide* will shortly be at the rehearsal of the theatre of Darmstadt."

REGISTERING OF DUTY DONE BY STEAM.

Extract from Babbage's Economy of Manufactures.

The advantage arising from registering the duty done by steam-engines in Cornwall has been so great, that the proprietors of one of the largest mines, on which there are several engines, find it good economy to employ a man to measure the duty they perform every day. This daily report is fixed up at a particular hour, and the engine men are always in waiting, anxious to know the state of their engines. As the general reports are made monthly, if accident should cause a partial stoppage in the flue of any of the boilers, it might, without this daily check, continue two or three weeks before it could be discovered by a falling off of the duty of the engine. In several of the mines, a certain amount of duty is assigned to each engine; and if it does more, the proprietors give a premium to the engineers, according to its amount. This is called million money, and is a great stimulus to economy in working the engine.

To the Editor of the Mechanic and Chemist.

Sir,—It struck me that something of this sort might be adopted on our steamboat engines with good effect, by registering the number of strokes which should be made in a given time; and the quantity of fuel consumed in a like period, the average duty of our steam-engines might be ascertained.

I am, Sir, yours truly,

Gamma.

ON THE MECHANICAL POWERS.

NO. IX.

When a road directly ascends the side of a hill, it is to be considered as an inclined plane; but it will not lose its mechanical character if, instead of directly ascending towards the top of the hill, it winds successively round it, and gradually ascends, so as, after several revolutions, to reach the top. In the same manner a path may be conceived to surround a pillar, by which the ascent may be facilitated upon the principle of the inclined plane. Winding stairs, constructed in the interior of great columns, partake of this character; for although the ascent be produced by successive steps, yet if a floor could be made sufficiently rough to prevent the feet from slipping, the ascent would be accomplished with equal facility. In such a case, the winding path would be equivalent to an inclined plane, bent into such a form as to accommodate it to the peculiar circumstances in which it would be required to be used. It will not be difficult to trace the resemblance between such an adaptation of the inclined plane, and the appearances presented by the thread of a *screw*; and hence it may easily be inferred that a screw is nothing more than an inclined plane constructed upon the surface of a cylinder. Let A B, fig. 1, be a common round ruler, and let C D E be a piece of white paper, cut in the form of an inclined plane, whose height, C D, is equal to the length of the ruler, A B, and let the edge, C E, of the paper be marked with a broad black line; let the edge, C D, be applied to the ruler, A B, and being attached thereto, let the paper be rolled round the ruler, the ruler will then present the appearance of a screw, fig. 2, the thread of the screw being marked by the black line, C E, winding continually round the ruler. Let D F, fig. 1, be equal to the circumference of the ruler, and draw F G parallel to D C, and G H parallel to D E, the part C G F D of the paper, will exactly surround the ruler once; the part C G will form one spire of the thread, and may be considered as the length of one inclined plane surrounding the cylinder, C H being the corresponding height, and G H the base. The power of the screw does not act parallel to the plane, or thread, but at right angles to the length of the cylinder, A B; therefore the proportion of the power to the weight will be the same as that of C H to the space through which the power moves parallel to H G, in one revolution of the screw. H C is evidently the distance between the successive positions of the thread, as it winds round the cylinder; and the less the distance is, or, in other words, the finer the thread is, the more

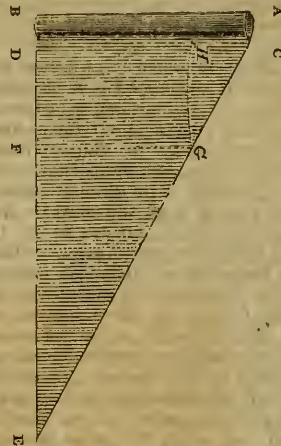


Fig. 1.

Fig. 2.

powerful the machine will be. In the application of the screw, the weight or resistance is not, as in the inclined plane and wedge, placed upon the surface of the plane, or thread. The power is usually transmitted by causing the screw to move in a concave cylinder, on the interior surface of which a spiral cavity is cut, corresponding exactly to the thread of the screw, and in which the thread will move, by turning round the screw continually in the same direction. This hollow cylinder is usually called the *nut*, or *concave screw*. A screw may be cut upon a cylinder, by placing the cylinder in a turning-lathe, and giving it a rotatory motion upon its axis. The cutting point is then presented to the cylinder, and moved in the direction of its length, at such a rate as to be carried through the distance between the intended thread, while the cylinder revolves once. The relative motions of the cutting point and the cylinder being preserved with perfect uniformity, the thread will be cut from one end to the other. The shape of the threads may be either square or triangular. In cases where liquids or juices are to be expressed from solid bodies, the screw is generally employed. It is also used in coining, where the impression of a dye is to be made upon a piece of metal, and in the same way in producing the impression of a seal upon wax, or

other substance adapted to receive it. When soft and light materials, such as cotton, are to be reduced to a convenient bulk for transportation, the screw is used to compress them, and they are thus reduced into hard dense masses. In printing, the paper is urged by a severe and sudden pressure upon the types, by means of a screw. As the mechanical power of the screw depends upon the relative magnitude of the circumference through which the power revolves, and the distance between the threads, it is evident, that to increase the efficacy of the machine, we must either increase the length of the lever, by which the power acts, or diminish the magnitude. Although there is no limit in theory to the increase of the mechanical efficacy by these means, yet practical inconvenience arises which effectually prevents that increase being carried beyond a certain extent. If the lever by which the power acts be increased, the same difficulty arises as explained in the wheel and axle; the space through which the power should act would be so unwieldy, that its application would become impracticable. If, on the other hand, the power of the machine be increased by diminishing the size of the thread, the strength of the thread will be so diminished, that a slight resistance will tear it from the cylinder. The case in which it is necessary to increase the power of the machine, being those in which the greatest resistances are to be overcome, the object will evidently be defeated, if the means chosen to increase that power deprive the machine of the strength which is necessary to sustain the force to which it is to be submitted. These inconveniences are removed by a contrivance of Mr. Hunter, which, while it gives to the machine all the requisite strength and compactness, allows it to have an almost unlimited degree of mechanical efficacy. This contrivance consists in the use of two screws, the threads of which may have any strength and magnitude, but which have a very small difference of breadth. While the working point is urged forward by that which has the greater thread, it is drawn back by that which has the less; so that during each revolution of the screw, instead of being advanced through a space equal to the magnitude of either of the threads, it moves through a space equal to their difference. The screw is very useful for the measurement of very minute motions and spaces, the magnitude of which could scarcely be determined by any other means. The very slow motion which may be imparted to the end of a screw by a very considerable motion in the power, renders it peculiarly well adapted for this purpose. Suppose a screw to be so cut as to have fifty threads in an inch, each revolution of the screw will advance its point through the fiftieth part of an inch. Now suppose the head of the screw to be a circle, whose diameter is an inch, the circumference of the head will be rather more than three inches; this may be easily divided into a hundred parts, distinctly visible. If a fixed index be presented to this graduated circumference, the hundredth part of a revolution of the screw may be observed, by noting the passage of one division of the head under the index. Since one entire revolution of the head moves the point through the fiftieth of an inch, one division will correspond to the five thousandth of an inch. In order to observe the motion of the point of the screw, a fine wire is attached to it, which is carried across the field of view of a powerful microscope, by which the motion is so magnified, as to be distinctly perceptible. A screw for such purposes is called a *micrometer screw*.

Example.—What power is necessary to raise a weight of 6000 lbs., the length of the lever being 20 inches, and the screw three quarters pitch?

$$20 \times 2 = 40 \times 3{\cdot}1416 = 125{\cdot}6 \text{ inches};$$
$$\text{then } 125{\cdot}6 : {\cdot}75 :: 6000,$$
$$\frac{6000 \times {\cdot}75}{125{\cdot}6} = 35{\cdot}8 \text{ lbs. power.}$$

THE ECCABEOLION, OR ARTIFICIAL HATCHING MACHINE.

Under this name, a novel and curious exhibition has been opened at No. 121, Pall-mall, which is a machine for artificial incubation. Similar attempts have been made on a small scale in this country by Mr. Mowbray and others; but these were merely scientific experiments, and their success depended on the degree of attention which would be incompatible with large numbers. The present machine is an oblong square wooden box, about nine feet in length and three in breadth, divided into eight compartments open to the sight, in which the eggs are deposited, being spread promiscuously on the floor. The heat is applied by pipes, which can easily be regulated to the required temperature of 98 degrees, when, under favourable circumstances, the principle of which is the quality of the egg, the process of incubation goes on successfully—the chickens issuing from the egg at the usual period of twenty-one days. After ten or

twelve hours they begin to feed, and are then removed into an apartment of a genial temperature, to which artificial farmyard they give a very animated appearance. The only part of the process of incubation that is visible is, of course, that of the chick issuing from the cell after its mature development; but scientific visitors may gratify their curiosity by breaking an egg at every successive stage. By the aid of a powerful light, likewise, the same interesting progress may be seen in the egg through the transparency of the shell. The exhibition itself is of a very interesting character, and likely to prove popular, as no where can the progressive development of animal life in its progress to maturity be so well shown or understood as in the facility afforded by this machine. The inventor is of opinion, that this plan might be successfully introduced in an economical point of view, were an extensive establishment formed in a favourable locality, as the apparatus is susceptible of an interminable produce, and that in this instance the supply both of eggs and poultry would become so plentiful, as not to be restricted to a luxury of life.—*Patriot.*

EMIGRATION TO AMERICA.

We uunderstand, that in February last, a band of nineteen mechanics left Manchester per railway for America. On Tuesday morning, at half-past eight, another band of fifteen, all mechanics, took their departure from Manchester for the same destination. From particular inquiries made respecting this latter deportation, it appears that they are all of them machine makers, and several of them from the eminent machine-making establishment of Messrs. Cocker and Higgins, of Salford. It is quite impossible for any but those who pay great attention to the matter (and who have at the same time ready access to the parties commissioned by the continental manufacturers and spinners to enter into engagements on their behalf), to form the least idea of the extent to which this sort of emigration is now conducted. But our readers will be still more surprised, perhaps, to learn, that even women and young girls, who have been brought up as spinners and piercers, &c., are now also regularly going to the continent to be employed in cotton mills. When it is considered, too, that such parties can now reach Ostend, or even Ghent, in less time, and at as little expense, as it took but only twenty years ago to reach London, there is little to be wondered at that the labouring classes should thus endeavour to dispose of their only merchandise (labour) to the best advantage. If, too it be considered, that, even at the present time, when mechanics are in full employ in this district, the various continental agents here find no difficulty in thus obtaining men by the score, what, let it be asked, may reasonably be anticipated should employment become really scarce? Why, instead of scores, thousands would at once seek their fortunes in a foreign land. The aristocracy of England may shut, or pretend to shut their eyes to the effects already produced, just as they list; but still it is impossible that anything less, and in a very short time indeed, than competition of so serious a nature will arise, as to make it indispensable for our spinners and manufacturers either to discontinue their work, or greatly reduce the wages of their work-people. Then will come the tug of war. The extremely depressed state of the spinning trade, which has now existed for many months, is, by the most reflecting part of the community, now solely attributed to such competition; and there only wants this conviction to become general, and wages must at once fall fearfully low. The landlords will then be forced to the conviction, that dear bread and high wages have necessary or immediate connection; but the worst of the matter will be, that this experience will come when it cannot be of any avail.—*Manchester Times.*

HISTORY OF ARCHITECTURE.

NO. I.

It is a general practice, when about to write on any subject, to give a definition of the word embracing the topic to be treated of; so I shall commence by stating, that the term architecture is derived from the Latin verb *architector*, which also has its derivation from the Greek. The dictionary meaning of the word architecture is "the science of building." This, I think, is incorrect; for a building can exist without architecture, taking it rather to mean the proportion and elegance, than the building itself. Thus, a house erected with no regard to appearance, a few bricks displaced for a window, and an awkward gap for the door, could not surely be styled "architectural." But, suppose we reduce the windows and doors to squares, and even forms, enrich them with mouldings, add beautiful ornament to the otherwise bare walls, and regulate their elegance with symmetrical arrangement, then we may with truth apply to the build-

ing the term "architecture." Algarotti observes in one of his works, "it (architecture) may be said to hold the same place among the arts that metaphysics does among the sciences." The history of this science embraces an account of its origin and gradual advancement in different ages, and various countries. After these preliminary observations, I proceed to the subject in view, "the history of architecture."

As most of the early tribes were of savage and wandering habits, their habitations, if they had any, must have been of the most moveable nature; but more probably they halted under some trees, and rested at night beneath their shelter on skins; however, when their numbers increased, and they became more settled, congregating in various places for longer periods, something more permanent was required, and the most natural idea appears to be a kind of hut made of boughs of trees, in the shape of a rude cone, similar to the Wigwams of the North American Indians. But the progress of architecture can be far better traced in religious edifices. Superstitious devotion, which in all nations has so powerful a sway, would require peculiar attention to the erection of its edifices, consequently *religious*, would be much in advance of mere *house* architecture; this is the case *now*, and it was *then*.

The earliest specimens we hear of are altars; of these, many at present exist in our own country. At Stonehenge, on Salisbury plain, there are many, which appear to have originally formed concentric circles, and on which, there is no doubt, the Druids were wont to offer sacrifice. We read of altars in the Bible as far back as the Deluge. They appear to have been at first one immense stone, standing singly, or supported on one or more similar stones. Many architectural writers consider these to have been the origin of columns, and consequently of columnar arrangement. Vitruvius, the earliest writer on this subject extant, commits such egregious blunders* as to the origin of columns, that we can put no faith in him. Others assert, that the trunks of trees were the origin, but I would rather agree with the former. One proof of its correctness is, that the most sensible writers on the subject have taken up the former idea, and *vice versa* as to the latter.

* One proof of the incorrectness of his statements is, that he erroneously describes eleven existing edifices.

At Armada, in Nubia, we find an ancient temple, consisting of huge square stones, supported on immense blocks of stone forming piers, and which seems to be the next step in advance upon the simple altar. Having thus travelled a short distance in the "history of architecture," we will, in the next paper, turn our attention to Egyptian architecture.

PROPORTIO.

New Houses of Parliament.—Since the foundation stone of the river wall for the new houses of Parliament was lain (early in March), and upon which the wings of the main front will stand, the works in that part have made considerable progress. Nearly the whole length of the wall is founded. At the north end, nearest Westminster-bridge, several heights of finely-wrought Scotch granite stone have been laid. The other end appears to have been delayed owing to an additional depth being taken out for the removal of decayed wood, shells, and soft ground, which was afterwards filled in with concrete. The wall is apparently of great strength. A material called pozzalano, is imported from Italy to strengthen the mortar. The works are done within a coffer-dam, which is nearly 400 yards in length, and has so effectually resisted the highest tides, that the workmen seem quite unconscious of any danger, although the foundation of the wall is many feet below the bed of the river.—*Times.*

Sir John Soane's Museum.—This valuable collection was opened on Thursday to the public for the season, and during the day there was a great number of visitors. The arrangements are very satisfactory, and the collection is so varied as to gratify every taste. The prominent object is, of course, the alabaster sarcophagus, which the testator obtained from the late Mr. Belzoni for 2,000 guineas. The museum will continue open every Thursday and Friday in this and the two succeeding months, tickets being obtained on previous application.—*Times.*

An easy problem for young Algebraists.—Given the eccentricity ($= a$) of an ellipse, and a mean proportional ($= b$) between the two parts of the major axis made by cutting it at a focus, to find that axis by a simple or quadratic equation.

C—s C—r.

The Ællopodes.—This singular invention is now exhibiting at the Lowther Rooms, King William-street, West Strand, and is drawing a great number of visitors.

UNIFORM PENNY POSTAGE.

To the Editor of the Mechanic and Chemist.

SIR,—You will at first, no doubt, be rather surprised at my addressing you on this subject, and perhaps you will think it one which should not have found its way into the pages of your magazine; but I hope, when you have perused the accompanying extract from the "Report of the Select Committee of the House of Commons on Postage," you will be disposed to alter your opinions, and to admit that it is of the greatest consequence, not only to you but to every one who has either business or friends, that the rates of postage should be materially reduced. The following extract, which I have copied from the *Times* of Wednesday, April 3, will throw some little light on the subject:—

"*Suppression of Correspondence.*—The multitude of transactions which, owing to the high rates of postage, are prevented from being done, or which, if done, are not announced, or are delayed to be announced, is quite astonishing. Bills for moderate amounts are not drawn; small orders for goods are not given; or received remittances of money are not acknowledged; the expediting of goods by land or sea; the sailing or arriving of ships is not announced, and insurances thereon are thereby prevented from being effected; printers do not send their proofs; the town dealer does not inform his country customers when to expect the arrival of his traveller; the country attorney delays writing to his London agent; the commercial traveller to his principal, the town banker to the banker in the country; branch banks delay remitting to their central bank, in all which, and many other cases, instead of communication taking place from day to day, as matters arise, regularity, which is the soul of business, is dispensed with."

I think, after this, you will not say you are not interested for the penny postage. If the public is interested, the best thing to do, will be to petition for it. By applying to the newsmonger who supplies this magazine, he will allow any person to peruse for a few minutes a number of "Nicholas Nickleby," on the last page of advertisements of this periodical, will be found the form of a petition to both houses of Parliament; get about three or four dozen signatures to it, and then transmit it, as directed by the aforesaid advertisement, and it will be passing strange if you do not meet with success.

Ever yours in a good cause,

GAMMA.

[This letter was evidently written before our worthy Correspondent was aware that we had anticipated his wishes in our last number; the form of petition is thus given in a supplement to the *Spectator*:—

To the Honourable the Lords Spiritual and Temporal (or *the Commons*, as the case may be) *in Parliament assembled*,

The humble Petition of the undersigned (*to be filled up with the name of place, corporation, &c.*)

SHEWETH,

That your petitioners earnestly desire an uniform penny post, payable in advance, as proposed by Rowland Hill, and recommended by the Report of the Select Committee of the House of Commons.

That your petitioners intreat your Honourable House to give instant effect to this Report. And your petitioners will ever pray.

Mothers and Fathers that wish to hear from their absent children!

Friends who are parted, that wish to write to each other!

Emigrants that do not forget their native homes!

Farmers that wish to know the best markets!

Merchants and Tradesmen that wish to receive orders and money quickly and cheaply!

Mechanics and Labourers that wish to learn where good work and high wages are to be had! support the report of the House of Commons with your petitions for an UNIFORM PENNY POSTAGE.

Let every city and town and village, every corporation, every religious society and congregation, petition, and let every one in the kingdom sign a petition, with his name or mark. *This is no question of party politics.* Lord Ashburton, a conservative, and one of the richest noblemen in the country, spoke these impressive words before the House of Commons Committee, "Postage is one of the worst of our taxes; it is, in fact, taxing the conversation of people who live at a distance from each other. The communication of letters by persons living at a distance, is the same as a communication by word of mouth between persons living in the same town."

"Sixpence," says Mr. Brewin, "is the third of a poor man's income; if a gentleman who had 1000*l.* a year, or 3*l.* a day, had to pay one-third of his daily income, a sovereign for a letter, how often would he write letters of friendship? Let a gentleman put that to himself, and then he will be able to see how the poor man cannot be able to spare sixpence for his letter." READER! If you can get any sig-

natures to a petition, make two copies of the above on two half sheets of paper; get them signed as numerously as possible; fold each up separately; put a slip of paper around, leaving the ends open; direct one to a member of the House of Lords, the other to a member of the House of Commons, *London*, and then put them into the Post Office.

We earnestly recommend our readers to support this important measure in the manner above described; and we trust that *all* contemporary publications admitting subjects of this nature, will, if they have not done so already, join in the good cause. We also advise our readers to attend to the council given in our last, anything tending to diminish the revenue of the Post Office, will produce more effect than reams of petitions; but we must not on that account neglect an auxiliary which *every one has power to command;* for although the effect of petitioning is not immediately perceived, still it reminds members of their duty, and strengthens the supporters of the cause with an unquestionable proof of the desire of an immense majorityof the nation.]

ORIGIN OF THE POWER-LOOM.

In consequence of Arkwright's machithere would be a difficulty in weaving nery for spinning, it was soon found that all the yarn that could be spun. It was remarked in a company where Mr. Cartwright was present, in 1784, that, in order to remedy this evil, Mr. Arkwright must exercise his ingenuity and invent a weaving mill, in order to work up the yarn which should be spun in his spinning mills. The subject was discussed; and it was pronounced by the gentlemen present, who were manufacturers from Manchester, to be impossible. Mr. Cartwright thought otherwise; he said there had been lately exhibited in London a machine for playing chess; and he felt quite sure that it could not be more difficult to construct a machine to weave cloth, than a machine which could go through all the movements of such a complicated game. Mr. Cartwright was a clergyman, forty years old, and had never given his attention to the subject of machinery. This subject, however, was so strongly on his mind, that some time afterwards he resolved to make the attempt to invent a weaving machine. He had not at that time, it appears, ever seen a common loom. But reasoning upon the nature of the process necessary to be gone through to cross the threads in such a way as to make a piece of cloth, he hit upon the plan of a loom, and, with the assistance of a carpenter and blacksmith, he made one. It was a very rude machine. "The warp," says Mr. Cartwright, "was laid perpendicularly, the reed fell with a force of at least half a hundred weight, and the springs which threw the shuttle were strong enough to throw a Congreve rocket." Besides this, it required the strength of two powerful men to work it, and that at a slow rate, for a short time. But the principle was there. Mr. Cartwright now went and examined the looms of common form, and soon succeeded in constructing one very nearly resembling the power-looms which are now in use. In the account of this interesting invention, which I am quoting, it is said that "Dr. Cartwright's children still remember often seeing their father, about this time, walking to and fro in deep meditation, and occasionally throwing his arms from side to side, on which they used to be told that he was thinking of weaving and throwing the shuttle." Some time after he had brought his first loom to perfection, a manufacturer, who had called upon him to see it at work, after expressing his admiration at the ingenuity displayed in it, remarked that, wonderful as Mr. Cartwright's mechanical skill was, there was one thing that would effectually baffle him, and that was the weaving of patterns in checks, or, in other words, the combining in the same web of a pattern for fancy figure, with the crossing colours that make the check. Mr. Cartwright made no reply to this observation at the time; but, some weeks after, on receiving a second visit from the same person, he had the pleasure of showing him a piece of muslin, of the description mentioned, beautifully woven by machinery. The man was so astonished, that he declared that something more than human agency must have been concerned in the fabric."—*Everett.*

PTOLEMY'S MIRROR.

It is affirmed by various authors, that *Ptolemy Energetes* placed a mirror upon the tower of the light house of Alexandria, which represented distinctly all that was doing throughout Egypt, both at sea and on land. Some authors say, that in this mirror the enemy's fleet was seen when at a distance of six hundred thousand paces; others say five hundred parasages, which would make the distance more than a hundred leagues.

Almost all those who speak of this fact, regard it as a fabulous tale, and a thing impossible. There are even celebrated

opticians who have thought that if true, it could only be the effect of magic, and the prestiges of the devil. Such, amongst others, is the *P. Kircher*, who, in speaking of several superstitions stories, places this in the same class. (*Ars Magna Lucis et Umbræ*, l. 10, c. 1.) Experience has shown that a great number of facts have been regarded as chimerical by many philosophers, and after having been better examined by other philosophers, they have been found not only possible, but actually existing; this may, abating the manifest exageration of the story, be the case with the mirror of Ptolemy; but it is not from the authority of ancient commentators, but the laws of optics, dioptrics, and catoptrics, that reasons must be deduced for condemning it as fabulous, or demonstrating its possibility.

It frequently happens, that when historians recite historical facts connected with sciences, which they do not understand, their descriptions are erroneous, obscure, and sometimes unintelligible, or rendered impossible by the addition of circumstances suggested by their ignorance and inaccurate information. They are usually entirely ignorant, or possess but a very superficial knowledge of the sciences which are necessary to explain the principles upon which the mirror of Ptolemy was constructed, if ever it did exist. We must not, therefore, condemn the fact as fabulous, because historians speak of circumstances which we know to be impossible, and consequently untrue.

It is evident that the possibility of the principal fact, and foundation of this history, consists in the possibility of forming a mirror which will exhibit distant objects with the same distinctness as a good telescope. The proof of this possibility depends upon several delicate experiments in catoptrics and dioptrics, which are thus described by the P. Bonaventure :—

Demonstration of the possibility of the Fact.—Make a spherical concave mirror, of great dimensions, and a portion of a great sphere ; in this mirror distant objects will be seen as distinctly as with a good telescope. The spectator must be placed between the object and the mirror, so as not to intercept the rays which proceed from the object, and fall upon the mirror. The mirror must be placed so that the incident, rays, and those which are reflected from the surface of the mirror and meet the eye of the spectator, form a small angle with the axis. These conditions being observed, the following facts are established :—

1st. If the eye be placed near the focus, the object will be seen much magnified, and in its natural position. But it must be observed, that if the spectator be near-sighted, the image will appear confused; if his sight be good, he will see the objects greatly magnified, but not distinct, unless the mirror be a portion of a very great sphere. If the eye be long-sighted, as happens to aged persons, he may place himself at a distance, at which he will see the objects as clearly as if he were looking through a good telescope.

2nd. If the spectator be placed exactly at the focus, or very near to it, the image will be confused, and he will be unable to distinguish the objects.

3rd. If the spectator place himself further from the mirror than the focus, so that the eye shall be as far distant from the focus, as he would place a book to read with ease, in this case, whatever may be the nature of his sight, long or short, he will see the objects greatly magnified and very distinct, as clearly as if he were looking through a good telescope. It must be remarked, however, that in this case the objects will be reversed. These facts are proved by the following experiments :

Experiment 1st.—Take a plano-convex lens, and silver the convex side, which will form a plano-concave mirror. The lens employed in this experiment by the P. Bonaventure, was about six inches in diameter, and its focus about twenty-two feet. Placing himself before this mirror, he saw distinctly all the distant objects which were before it. This glass was badly polished, and otherwise imperfect, which considerably diminished the effect which would have been produced without those imperfections. It was also too small, which was another impediment to the production of the greatest effect. Metallic mirrors accurately made and well polished, are in several respects preferable to glass for this purpose.

Experiment 2nd.—A lens of equal convexity on each side, was employed without silvering ; it was six inches and a half in diameter, and a portion of a sphere of forty-four feet diameter ; the focus formed by the reflection of the rays, which, after passing through the first surface, were reflected by the second, was about five feet and a half. This glass was placed in the same manner as the mirror described in the preceding experiment, to see the objects by the reflection of the second surface, and they were distinctly visible. It is evident, that the number of reflected rays must be very small, from the unsilvered surface of this glass, and consequently it would have produced a consi-

derably greater effect, if it had been silvered. It may be even concluded from this, that a concave mirror of polished metal, with a focus of five feet and a half, would produce a good effect, even with the small surface of this lens. When it is found that a single convex lens will show distant objects by refraction, as distinctly as a telescope composed of several glasses, it is easy to conceive that the same effect may be produced by a single concave mirror. Various experiments are described by different authors, showing that, by peculiar management, distinct vision may be obtained by a single convex lens. The P. Bonaventure says, "With a lens of three feet focus, and six inches diameter, placing the eye further from the glass than the focus, I saw distant objects clearly and distinctly, considerably magnified and reversed. This glass was convex on both sides. 2nd. I have observed the same effect with still more clearness and distinctness, with another glass, plano-convex, the convexity being a portion of a sphere of six feet diameter, and the glass itself seven inches in diameter. 3rd. The distinctness with which I have seen distant objects, has been still greater when I have employed a lens, convex on both sides, six inches and a half in diameter, and a focus of twenty-two feet. With this glass I could see very clearly objects which I could not so well distinguish with a good telescope. Objects seen through these large glasses, appear much brighter than to the naked eye, in the same manner as if they were illuminated by a greater light than they really are. This is so sensible, that the other objects which are seen without the interposition of the glass, and contiguous to those which are seen through it, appear dark, although they are all equally illuminated. The contrary is experienced when we look through a telescope, they always appear less illuminated than when seen by the naked eye. From this it follows, that large convex lenses, and concave mirrors, might be advantageously employed in the night, and in obscure places, to see objects which are not sufficiently illuminated to be distinguished without that help; it has happened on a dark night, that I have seen objects distinctly with one of the lenses before described, although I could not distinguish them at all without that assistance."

There is, doubtless, some degree of exaggeration and partiality in this relation; but it is equally clear that effects may be produced by concave mirrors, which, though far inferior to the power of modern telescopes, might nevertheless have excited great astonishment and admiration at a period when no other instrument of the kind was known; it must also be remarked, that although it is assumed by the various writers who have treated upon this subject, that the mirror of Ptolemy was a spherical segment, it might have been so constructed as to cause the rays to converge accurately, which is not the case when parallel rays fall on a spherical reflector. The description of this instrument, as transmitted to us by ancient writers, is so enveloped in fable, and so obscurely and inaccurately expressed, that neither its construction nor power can be ascertained; but that it did exist, is highly probable, and the possibility of its existence is established beyond a doubt; we leave the further investigation of this subject to such of our ingenious readers as may be inclined to exercise their skill thereon.

EXPLOSION IN COAL MINES.

The explosion in an extensive coal-mine is horrible in the extreme. Let us imagine a mine upwards of 100 fathoms deep, with the workings extended to a great distance under the surrounding country, with machinery complete in all its parts, the mining operations under regular discipline, and railways conducted through all its ramifications; the stoppings, passing doors, brattices, and the entire economy of the mine so arranged, that every thing moves like a well-regulated machine. A mine of this magnitude in full work is a scene of cheerful animation, and happy industry; the sound of the hammer resounds in every quarter, and the numerous carriages, loaded or empty, passing swiftly to and fro from the wall faces to the pit bottom, enliven the gloomiest recesses. At each door a little boy, called a trapper, is stationed, to open and shut it. Every person is at his post, displaying an alacrity and happiness pleasingly contrasted with the surrounding gloom. While things are in this merry train, it has but too frequently happened, that from some unforeseen cause, the ventilation has partially stagnated, allowing a quantity of fire-damp to accumulate in one space to the explosive pitch; or a blower has suddenly sprung forth, and the unsuspecting miner entering this fatal region with his candle, sets the whole in a blaze of burning air, which immediately suffocates and scorches to death every living creature within its sphere, while multitudes beyond the reach of the flame are

dashed to pieces by the force of the explosion, rolling like thunder along the winding galleries.. Sometimes the explosive flame seems to linger in one district for a few moments; then gathering strength for a giant effort, it rushes forth from its cell with the violence of a hurricane, and the speed of lightning, destroying every obstacle in its way to the upcast shaft. Its power seems to be irresistible. The stoppings are burst through, the doors are shivered into a thousand pieces; while the unfortunate miners, men, women, and boys, are swept along with an inconceivable velocity in one body, with the horses, carriages, corves, and coals. Should a massive pillar obstruct the direct course of the aerial torrent, all these objects are dashed against it, and there prostrated or heaped up in a mass of common ruin, mutilation, and death. Others are carried directly to the shaft, and are either buried amid the wreck, or are blown up and ejected from the pit mouth. Even at this distance from the explosive den, the blast is often so powerful, that it frequently tears the battrice walls of the shaft to pieces, and blows the corves suspended in the shaft as high up into the open air as the ropes will permit. Not unfrequently, indeed, the ponderous pulley-wheels are blown from the pit-head frame, and carried to a considerable distance in the bosom of a thick cloud of coals and coal-dust, brought up from the mine by the fire-damp, whose explosion shakes absolutely the superincumbent solid earth itself with a mimic earthquake. The dust of the ruins is sometimes thrown to such a height above the pit, as to obscure the light of the sun. The silence which succeeds to this awful turmoil is no less formidable; for the atmospheric back-draught, rushing down the shaft, denotes the consumption of vital air in the mine, and the production of the deleterious choke-damp and azote.—*Dr. Ure's Dic. of Arts*, Part viii.

EXPERIMENTAL SUBTERRANEOUS AND SUBAQUEOUS EXPLOSION AT CHATHAM BY THE VOLTAIC BATTERY.

For several months past, the Royal Engineers at Chatham, under Colonel Paisley, have been trying experiments in firing gunpowder by the voltaic battery, chiefly under water; and, after many vicissitudes of partial success and of failure, they have at last succeeded in bringing this process to as much perfection as it seems capable of—that is, to as much certainty as the former methods of firing mines in dry soil. They have repeatedly fired gunpowder at the distance of 500 feet, with their conducting wires either buried under ground or led entirely under water, excepting a few feet connected with the battery, which in their subaqueous explosions was in a boat on the Medway, the powder being lodged at the bottom of that river. In their subterraneous explosion they blew up a field-work, and in one of their subaqueous experiments they blew to pieces a vessel representing a wreck, the fragments of which being of fir timber came up to the surface of the Medway immediately after the column of water thrown up by the explosion. On Saturday last they applied their voltaic battery to the blasting of rock under water. Two very large and heavy pieces of hard sandstone were each prepared with a hole three inches in diameter by the borer, after which a charge of three-quarters of a pound of powder was put into each, and the upper part of the hole was tamped, by pouring in small fragments of broken stone round a cone fixed over each charge, in a new and ingenious manner, first suggested by Mr. Howe, clerk of the works of the Royal Engineer Establishment, more than five years ago, which does not seem inferior in resistance to the common mode of tamping, but is much safer, and far more expeditious. The conducting wires were led from each charge to the battery, which was placed on the gun-wharf, whilst the stones thus prepared and loaded, were lowered down from a crane to the bottom of the river opposite, where the water was 14 feet deep at the time. The first stone, being of a compact form, was blown to pieces, and the rope sling by which it had been lowered, and which had not been removed, was broken. The second stone, being of a more irregular shape, and much thinner, so that there was not sufficient resistance above and below the charge, was brought up by the crane after the explosion, which had only blown out the solid part of the stone below the bottom of the hole, apparently without injuring any other part of it. Another charge was therefore placed in the same hole, which was tamped, both above and below, in the mode before described, and the stone was again let down to the bottom of the river, and after firing this second charge, on being hauled up by the crane, it was found to have been broken into three parts, one of which did not reach the surface, whilst the other two, being still held together by the slings, af-

ter being raised nearly to the level of the wharf, separated from each other, and fell to the bottom. One of these charges was contained in a tin cylinder fitted to the size of the hole, the two others in canvass bags of the same form covered with waterproof composition. These last experiments, which, like several of the former, were witnessed by a great number of spectators, chiefly military, have proved that the voltaic battery may succeed for blasting rock under water, as well as for blowing wrecks to pieces ; and in the former supposition, the holes in the rock would be formed, and the charges placed by means of the diving-bell.

The results of this course of experiments may be of great importance, especially for defensive military mines, because the voltaic battery affords the only possible means of firing several such mines, not only instantaneously but simultaneously, and at the very moment when an enemy's column advancing to the assault, is over the spot where these mines have been prepared ; whereas by the common mode of firing military mines, by a piece of portfire or slow match connected to a powder hose, there can be no certainty of their taking effect at the precise moment required, so that the enemy's troops might either have passed over, or not yet reached the spot, at the period of explosion ; and the simultaneous explosions of conjunct mines by this method is out of the question, for no two pieces of portfire or powder hose, though cut to the same length, were ever known to burn exactly alike. For subaqueous explosions, the superiority of the voltaic battery is still more striking—so much so, that Colonel Pasley has repeatedly declared, that if he had been possessed of the same apparatus, and had known how to use it, last year in his operations in the Thames, it would have saved a great deal of trouble and expense.

Nothing can appear easier than to fire gunpowder under water by the voltaic battery, as exhibited in a lecture-room or scientific institution, but the mode usually adoped on such occasions, of passing the conducting wires into the charge through a cork coated with sealing-wax, and of insulating the remaining length of each wire by enclosing it in small India rubber tubes, is inadequate and inexpedient for practical purposes in a rapid tideway and in deep water. In Colonel Pasley's experiments at Chatham, corks and sealing-wax were rejected, the former as being too weak, the latter from being liable to crack, and India rubber or caoutchouc was also rejected, as being far too expensive ; instead of which a composition of pitch, softened by beeswax or tallow, was adopted, the remarkable efficiency of which was proved by keeping one of those experimental charges ten days under water before it was fired, when the powder was still perfectly dry. Each pair of conducting wires used in these experiments was always attached to a rope or line, previously saturated with boiling tar, to prevent it from tearing asunder the soldered joints of the wires, by its alternate contraction and expansion when wet and dry, an effect which on one occasion actually took place before the rope was so saturated. The two wires and rope were bound together by tape, and served round with hemp yarn, and in this state they had the appearance of a single rope capable of being coiled or veered out conveniently. One of the most important points necessary was to prevent all strain acting upon the conducting wires from without, and thereby breaking the very small delicate platinum wire within the charge, which, by interrupting the circuit, would render explosion impossible. To guard against this cause of failure in the shocks to which the conducting wires may be exposed in a rapid tideway appeared at first a very difficult task.

The voltaic battery used was of Professor Daniell's improved construction, which, from retaining its energy much longer than any former voltaic battery, he has named the constant voltaic battery, and which Colonel Pasley found to be much superior to the best of the former constructions, at least for the peculiar purpose of firing gunpowder either under ground or under water. Sergeant-Major Jones, and the non-commissioned officers and privates who have been employed in these experiments, are now as expert in the use of this battery as can be desired, and, being artificers, they are able to make as well as to use such batteries.

Having described these recent interesting experiments of the engineers at Chatham, we may add a brief historical notice of what has been done before. No doubt small charges of gunpowder must have been fired by the voltaic battery, as a matter of experiment and of curiosity, almost as soon as the first rude battery of that description was invented, but the merit of having first applied it to practical purposes is due to Dr. Hare, of Philadelphia, whose proceedings were published some years ago in Silliman's *American Journal of Science* (vol. xxi., page 139), and more recently in a paper communi-

cated to the British Association in 1836, and published in vol. v., in the transactions of the sections for that year, page 45. Dr. Hare states that he used it in blasting rock for the purposes of building, and that he has even fired 12 blasts simultaneously at the distance of 150 feet, by a powerful voltaic battery of a very ingenious and peculiar construction, which he calls a *calorimeter.* He says that the same process might be applied for blasting under water, but he does not mention that he had ever done so himself. Colonel Pasley, after comparing Dr. Hare's mode of firing charges simultaneously, with other modes which he also tried, considers the doctor's method of soldering the wires together in two parcels, one to be led to one pole, and the other to the other pole, of the voltaic battery, to be the best, and not likely to be improved upon; but he has not adopted any of the Doctor's other arrangements, as they are not applicable to subaqueous explosions under difficult circumstances, and he neither uses the large nor small iron wires, nor the fulminating powder recommended by Dr. Hare. His own experiments for firing several charges simultaneously have as yet only succeeded at very short distances, because he had not a sufficient quantity of thick copper wire in his possession; and therefore was obliged to employ common bell-wires, only 1-16th of an inch in diameter, which are comparatively useless, the best conducting wires being those of 1-5th of an inch in diameter, which should always be used for great explosions, and none less than 1-8th of an inch even for small explosions or for blasting. The officers who witnessed the various experiments at Chatham are therefore of opinion that it would be absolutely impracticable to fire gunpowder under water at the distance of 300 or 400 yards by six of Professor Daniell's cells, with conducting wires only about as thick as a common bell-wire, as was asserted in a paper on the subject of blasting rocks by galvanism, published in a scientific journal for the month of May, 1838; instead of which, they think that to produce ignition by such wires at the last-named distance would require the operator to go to the enormous expense of providing himself with a most unwieldy battery of far greater power than has ever yet been used within the memory of man, for in their own experiments they never succeeded in firing a subaqueous charge, even at the distance of 100 feet, by fewer than eight cells, with common bell-wires; whereas, in using the large wires, the same number of cells was found capable of producing ignition at five times that distance.

We shall conclude by mentioning with due applause the extraordinary success of Mr. William Snow Harris, of Devonport, who did wonders in firing gunpowder by wires led through water at a great distance by the common electrical machine in 1823. But for a detailed account of the interesting experiments of this justly celebrated electrician, which astonished a number of distinguished naval officers and other spectators at Devonport at the period alluded to, we must refer to the *British Press* newspaper of the 17th of March of that year. Notwithstanding this brilliant success, the voltaic battery must be considered preferable to the electrical machine, because the latter requires a much longer apprenticeship to use it properly; and one cannot expect such skilful manipulation as Mr. Harris has displayed either from military or from civil miners; besides which, that gentleman worked from a warm dry cabin, which is indispensable to the success of the electrical machine; whereas in the experiments of the engineers at Chatham the charges were always fired from Daniell's voltaic battery in the open air, often when exposed to heavy rains, and on one occasion during a very violent snow storm.—*Times.*

To our younger Readers.—The spring and summer seasons are rapidly approaching, and many of our juvenile friends will, no doubt, be visiting their grandpapas, great uncles, and uncles, at their various farm-houses in the country. Whilst we wish them all the pleasure which we ourselves as boys remember to have enjoyed, and as much more as circumstances will allow, we have only to throw out one hint to them by the way, which is, to recommend them to procure a copy of a work, now before us, just brought out by Messrs. Darton and Clark, entitled "a Peep into the Agricultural World," or, "a Visit to a Farm-house," which contains about 50 descriptive engravings, and is decidedly one of the best books of the kind we have ever seen. Indeed, it is only for those who have not time or money at their command, to visit, in person, the scenes above alluded to, to acquaint themselves with the information contained in this admirable little work, and they will no longer run the risk of being laughed at by every plough-boy in the country, on account of their ignorance of agricultural pursuits.

RESEARCHES UPON THE PRODUCTION OF PHOSPHORESCENCE, AND UPON THE DIVERS PROPERTIES OF THE ELECTRICAL SPARK.

BY M. PREQUEREL.

The question which the author proposes to investigate, is this; what influence does the air, by its pressure or its temperature exercise upon the phenomena of phosphorescence? To resolve this, M. Brequerel exposed simultaneously to the air, and in a vacuum, calcined oyster-shells rendered phosphorescent by electricity. He observed, that their brilliancy remained sensibly the same in the two cases.

The electrical spark developed the same degree of phosphorescence, in the shells placed under a glass bell closed by a lamina of sulphated lime, whether the air in the bell was rarified or not. The calcareous sulphate was employed, because that crystal allows the phosphogenic property of the electrical spark to pass through it; but when this spark, which in all the experiments was produced by the discharge of a battery of eighteen jars, was operated in a vacuum, the other conditions remaining the same, the illumination produced was more feeble as the rarifaction increased, and *vice versâ*. This experiment was repeated several times with success, with oyster-shells and with other substances.

The construction of the apparatus was very simple; it was composed of two globes with tubes to admit metallic rods moveable in boxes stuffed with leather; the phosphorescent powder occupied the bottoms of these globes, and the neck of one of them was in communication with an air pump aspiring or condensing as the case required; the space which separated the rods in the interior of the globes, might be increased or diminished at pleasure, but always equal in both the globes, and so that the spark was transmitted simultaneously upon the two masses of phosphorescent powder. This arrangement permitted the operation at pleasure, of the compression or rarifaction of the air contained in the globe which communicated with the pump; when the air was rarified the powder became less brilliant, when it was condensed, the light which it emitted acquired a proportional intensity. The conclusion which M. Becquerel draws from these numerous facts is this: the electrical spark receives from the pressure of the air through which it passes, that modification which causes the radiation transmitted to phosporescent substances to increase or decrease with that pressure.

In a second series of experiments, the author has endeavoured to appreciate the influence of temperature. Two capsules, containing equal quantities of phosphorescent powder produced from the same calcination, were rendered luminous by atmospheric radiation; one of them was then placed in a refrigerant mixture of — 20 degrees (centigrade) while the other was exposed to the ordinary temperature of the atmosphere. The first ceased to shine long before the other; but if, at the moment the extinction commenced, the powder was poured out into another capsule which had not been cooled, it resumed its brilliancy; and such was its excitability, that a slight heat would make it again appear after a second extinction.

It was found, that shells thrown upon a shovel heated to 100 or 200 degrees, acquired only a faint light, of short duration, by the solar radiation; and when a red-hot shovel was used, that radiation lost its phosphogenic power. The natural consequence which results from these facts, is, that phosphorescent substances are more excitable by radiation, in proportion to the lowness of the temperature to which they are exposed.

To Prepare Solar Phosphorus.—Cleanse oyster-shells by washing, expose them to a red heat for half an hour, separate the purest part, and put it into a crucible (a small old flower-pot answers very well) in alternate layers with sulphur, till almost full; expose the vessel to a red heat for one hour at least; when cold, break the mass, and separate the whitest parts for use. When inclosed in a bottle, the figures of a watch may be distinguished by its light.

Coloured Flames.—Add a little boracic acid to a spoonful of alcohol, and stir them together in a saucer or cup, then set them on fire, and the flame will be of a beautiful green colour. If strontites in powder be added to alcohol, it burns with a carmine flame; if barytes be added, the flame is yellow; if the alcohol contain muriate of magnesia, it burns with a reddish-yellow flame.

Colophonite.—A blackish mineral, the *resinous garnet* of some authors, consisting of silica 35, alumina 13·5, lime 29·0, magnesia 6·5, oxide of iron 7·5, oxide of manganese 4·75, and oxide of titanium 0 5.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane.—Wednesday, April 17, Dr. Truman, on Comparative Physiology (conclusion). Friday, April 19, R. Addams, Esq., on Chemistry. At half past Eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road.—Tuesday, April 16, R. Guthrie, Esq, on the Rights of Man. At half-past Eight.

Poplar Institution, East India Road.—Tuesday, April 16, Mr. Gibbins, on Navigation. Friday, April 19, Discussion, on the Origin of Mankind.

Islington and Pentonville Philo-Scientific Society, *Prospect House*, *White-lion-street*.—Thursday, April 18, A Discussion on Temperance Societies. At Eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, April 17, Quarterly General Meeting. At half-past Eight o clock.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—I should be glad to know by what means the "dissolving views," which have been exhibited during Lent at the Italian Opera, are produced. They must, I apprehend, be painted on glass, and so thrown upon a transparent blind by a strong light placed behind the glass. I have tried a phantasmagoria, but cannot produce them by it, the transitions from one view to another being instantaneous instead of gradual. W. E. F.

Sir,—Can you or any of your correspondents inform me how to make the best copal varnish, such as is used for coach bodies, to dry in about twelve hours, and stating how the gum is dissolved, as I believe that is the greatest difficulty. G. M. H.

Sir,—I should feel obliged if you or any of your correspondents could inform me how the canvass used by artists in oil colours is prepared? W. L. B.

Sir,—Can you, or any of your Correspondents, inform me how to prepare essence of ginger, such as is commonly sold by chemists? JAMES.
Whitechapel.

Sir,—Can you, or any of your readers inform me of the best method of making the chrome yellow sold at colour shops for the use of painters, and how to differ the tints? J. N. C.

Sir,—Will you have the goodness, through the medium of your useful publication, to favour me with a receipt for making (or inform me where I can purchase ready made), the cement with which to fix the plates in the galvanic trough: I have tried several methods, none of which have succeeded to my expectations. A YOUNG EXPERIMENTALIST.

Sir,—Could you or any of your readers inform me where I can purchase a good powerful second-hand microscope. One suitable for botanical purposes would be preferred? Also, what is the most approved method of fastening butterflies' wings, so as to form artificial flowers, both as to form and cement or paste. A. STUBBS.

Sir,—Will you oblige me by inserting the following notice in your valuable journal:—I have by me a set of wheels, consisting of two large ones and one small; the large measuring 4 ft. 6 in., the smaller 2 ft. in diameter, being originally intended for a velocipede; they are made light but strong. Should any of your readers be in want of such a thing, they are to be disposed of at a cheap rate, and may be viewed at No. 24, Gloucester-street, Clerkenwell. C. H.

Sir,—You will confer on me a great favour by informing me of the means of removing the marks caused by Indian ink when stamped on the human skin, as I have been foolish enough to have my hands and arms marked with it, and I find it a great inconvenience to me as a tradesman. B. R.

[We fear that the injury which our correspondent has inconsiderately inflicted upon himself is irremediable; we can only appeal to our numerous and obliging readers, entreating them, if they are acquainted with any process by which marks of this kind may be removed, to favour us with a description of it.—ED.]

Sir,—Can any of your readers inform me where I can purchase a book on the art of painting landscapes without the aid of a drawing master? WM. CONQUEST.

Sir,—I should esteem it as a favour if you would allow me to ask, through the medium of your valuable journal, the best mode of preparing black paper, such as is used by the reporters for the public press in writing what they term "manifolds." I have tried several of the recipes of the reporters here, but I consider them capable of considerable improvement. Most of the prepared paper is apt to soil?
Manchester. REPORTER.

Sir,—Allow me to ask "Albinus Tusculum," whether he is acquainted with Mr. Prowett's beautiful mode of supplying the loss of teeth by others made of ivory, or any fitting material, which firmly adhere in their proper places by mere atmospheric pressure, without the aid of metallic wires, or any other contrivance? Mr. Prowett lives at No. 1, Spring-gardens. A. B. C.

Sir,—I should consider it a favour if any of your correspondents can inform me how to blue steel or iron, the same as saw-plates, stay-busks, &c. I find a heated plate does not produce a lasting colour?—Also the method of gilding picture-frames called water-gilding; how the plaster is laid on the wood to gild on so regular in thickness, and the size, so as to make a smooth surface. W. T. LOVE.
Hornechurch, March 14.

[This correspondent should have had the courtesy to pay the postage.]

Sir,—I shall feel particularly obliged by an early answer from you or any of your correspondents, to the following questions:—

Which is the best book on Voltaic electricity and electro-magnetism, for a beginner to learn the principles of the science, with experiments? Which is the best to use in practice, a Voltaic trough, or a circular pot battery? Does the power of the sustaining pot batteries depend on the quantity of surface of the zinc and copper? Also, if you would inform me in what former number I could find anything relating to Voltaic electricity? Also, whether Mr. James's battery is the best as far as regards the disposition of the zinc and copper plates? What is a calerometer? Where can I find a full description of Erricson's patent propellers; there is a small experimental boat with them in the West India Docks; would you give an account of them in your magazine? Also an account of the screw-propeller as applied to the boat built by Mr. Wimshurst, of Willwall, Poplar, which I hear answers well in still water, but whether it would in a tideway? Also, whether the bladder ought to entirely enclose the zinc on the copper side only, or on both sides in the sustaining battery described in a previous number, and how is it to be fastened, and where can I see one with it applied; and if the porous tubes that I am told are sold by Watkins and Hill, Charing-cross, are, instead of the bladder; and whether a preserving pot would not answer the purpose equally well, and if not, why? Also, if you know of any library in town (the nearer the Bank the better) where I could procure works on philosophy and science? COLES.

Sir,—Perhaps some of your correspondents can enlighten me on the following subject:—It is well known that prussiate of potash is considered a capital test for iron; most of our chemists stating, that when dropped into a liquid containing iron, a copious precipitate of Prussian blue is thrown down. But I find that when the prussiate of potash is dropped into a liquid acidulated with nitric acid, the same precipitate makes its appearance, indicating, of course, the presence of iron, where in reality none is present, or pos-

sibly can be, every care having been taken, that distilled water has been used, and where the best tests show no symptoms of its presence. O. S.

Sir,—Can any of your readers inform me how I can transfer prints, as I have seen on different kinds of wood ornaments; also if they can be transferred to paper. Z. I. G.

Sir,—Would you have the kindness to inform me by what means the transfer is made from paper to stone for lithography, and where I could purchase the ink and other requisites for the purpose of lithography? E. G. A.

ANSWERS TO QUERIES.

"Howard." The colours used in painting magic lantern slides, are those which are transparent, such as lake, carmine, sap-green, Prussian blue, distilled verdigris, gamboge, &c., ground in oil, and tempered with a proper varnish. A book in my possession states, "strong white varnish," but any varnish maker will inform you correctly. Draw on paper the subject you intend to paint, and fix it at each end to the glass; trace the outlines of the design with a fine hair pencil in strong tints in their proper colours, and when these are dry, fill up in their proper tints; shade with black or bistre, as you find convenient.

"A Beginner," The supports for the electrical cylinder may be made of thoroughly dry mahogany. A good work for you to study, will be the treatise on electricity published by the Society for Diffusion of Useful knowledge.

"J. Y." A cheap and useful blowpipe to keep up a continual current of air, may be made with a large bladder, having two tubes attached, one conveying air from the mouth to the bladder, the other from the bladder to the blowpipe jet, the bladder being placed between the knees. The first-named tube should have a valve opening inwards, and the jet should be fixed.

"R. T. N." may probably meet with the lapis calaminaris at a brass-founder's, or certainly at a geological specimen depot. There is one in the Strand.
F. E. L.

Sir,—In answer to "Mentor," No. 13. I have much pleasure in forwarding you a recipe for compounding the fumigating pastiles, extracted from the Pharmacologia of Dr. Faris:—Benzoin, 1 drachm; cascarilla, half a drachm; nitrate of potass, half a drachm; charcoal, 6 drachms; myrrh, 1 scruple, oil of nutmeg, 10 grains; oil of cloves, 10 grains; mucilage of gum tragacanth, a sufficient quantity.

"J. K." Cotton quick match is generally made of such cotton as is put into candles, from one to six threads thick, according to the pipe it is designed for, which pipe must be large enough for the match when made, to be pushed in easily, without breaking. The ingredients for the match are:—Cotton, 1 lb. 12oz; saltpetre, 1 lb.; meal-powder, 10 lbs.; spirit of wine, 2 quarts; isinglass, 3 gills. To dissolve 4 oz of isinglass, take three pints of water. The above is copied from Gregory's Encyclopedia, but I rather think "J. K." will find the following suit his purpose:—Cut the cotton into suitable lengths, wet it and roll it in meal powder, so as thoroughly to incorporate the one with the other; draw it through your hands to make it smooth and even, and hang it up to dry.
F. E. L

Sir,—Having frequent inquiries as to where copper wire could be covered for electro-magnetic experiments, I beg to inform your numerous readers (and especially those living at the east end of the town) that Mr. Henley, of 25, Back-church-lane, will cover any wire from 10*d.* per pound upwards, according to the degree of thinness, and will also make any other kind of apparatus connected with galvanism, at a very reduced price, in many cases amounting to only half the usual charge. F. White.
45, Gloucester-terrace, Commercial-road East.

"A Constant Reader" is informed, that Sir John Herschel's forty-feet telescope is to be seen at Slough near Windsor. The oxy-hydrogen microscope may be procured in Regent-street, corner of Jermyn-street. W. P. C.

Sir,—Your correspondent "H. H." may see, by applying as under, four thick quarto volumes of the Oxford Encyclopedia, and half the fifth; they are in good condition, and have been but very little used.
2, Artillery-court, Chiswell-street. H. P.

TO CORRESPONDENTS.

Theophilus.—*Our correspondent's list of grievances is so long, and most of his complaints of so dry and uninteresting a nature, that we feel it a duty towards our readers to answer them as briefly as possible. 1st. It appears that his queries have not all been answered: those which he has repeated shall be attended to; 2nd. He considers that we have given engravings of things too trivial for this work; others think that we sometimes treat upon subjects too difficult for a promiscuous reader, and the majority of our readers, we trust, will give us credit for introducing that variety of topics which will interest every one in turn; 3rd. He cannot understand the description of an hydraulic time-piece in a recent number; any person who has the least aptness for such things will explain it to him; 4th. Cannot be answered, as it is not stated to what number this complaint refers. Groan the fifth, is too vague to admit of an answer.*

W. P.—*When a simple rent takes place in a steam-boiler, the steam escapes, and the boiler remains in its place; but if the substance of which it is constructed be of a brittle nature, fragments are projected with great violence; for however large a portion may be detached, it is acted upon by a proportional force, that is, the pressure of the steam against the whole of its inner surface. The information he requires respecting the nutrition of different kinds of food, &c., he will find in a volume of Dr. Lardner's Cyclopedia on domestic economy.*

Electron.—*The suggestions of our esteemed correspondent will ever meet our attentive consideration; but we do not think that it would be advisable to number the queries which are inserted in this work; if the answer does not commence with a statement of the question, it will frequently be unintelligible; and that being done, the references to a number would be useless.*

Architector.—*Owing to the rapidity with which our correspondent's papers have apparently been written, several mistakes have occurred, which, in compliance with his request, we now correct: it cannot be expected that the printer can distinguish "skew" from "skene," "screws" from "screeds," &c., when they appear exactly alike in the manuscript. All terms of uncommon occurrence should be distinctly written. The following are the errata from the commencement of our correspondent's communications:—*

Errata.

Page 44, column 2, in the last line the comma between grey stone and lime ought to be omitted; page 59, col. 1, the words "there ought to be," in the thirty-second line, ought to appear after *footings*, in line 30; page 59, col. 2, line 11, for "fronted," read *pointed*; page 59, col. 2, line 2?, for "groated," read *grouted*, and for "groat," read *grout*; page 82, col. 2, line 20, for "skew," read *skene*; page 99, col. 1, for "skene back," read *skew back*; page 107, col. 1, line 42, for "hard float," read *hand float*; page 107, col. 1, line 48, "for "corners," read *cornices*; page 107, col. 1, line 55, for "coine," read *core*; page 107, col. 1, line 60, for "gereeds," read *screeds*; page 107, col. 2, line 6 for "screws," read *screeds*; page 107, col. 2, line 17, for "burnished," read *finished*.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); and published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

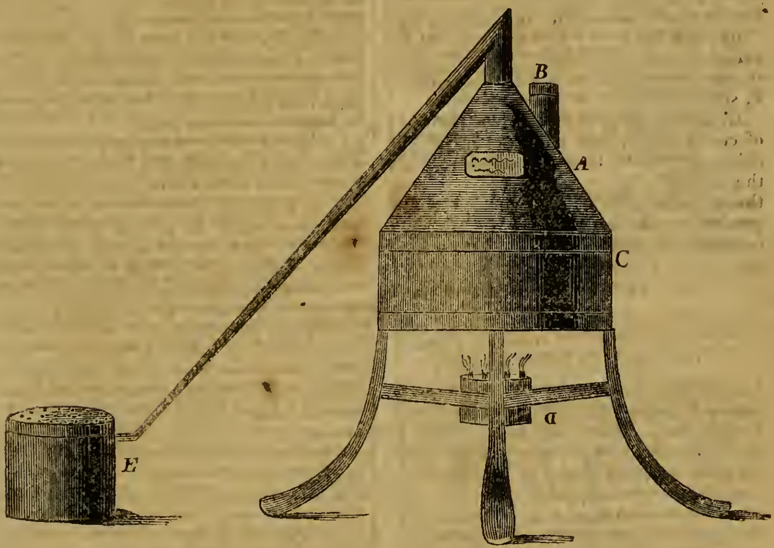
THE

MECHANIC AND CHEMIST.

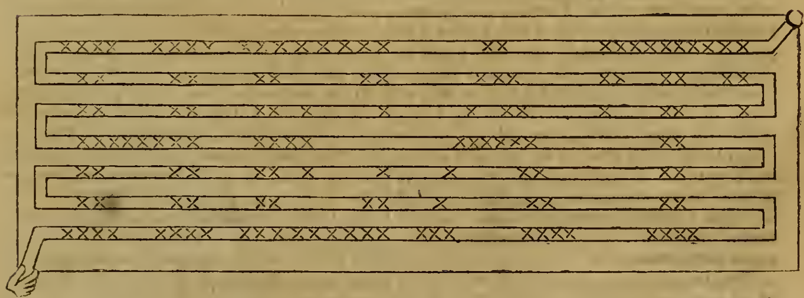
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XVIII. NEW SERIES. | SATURDAY, APRIL 20, 1839. (PRICE ONE PENNY.) | No. CXXXIX. OLD SERIES.

PORTABLE VAPOUR BATH.



ELECTRICAL EXPERIMENT WITH TIN FOIL.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PORTABLE VAPOUR BATH.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—I herewith send you a rough sketch of a cheap portable vapour bath, such as I have seen in use, to the greatest advantage, at a friend's house. It is a very simple and cheap, but valuable little contrivance; suited to the means of the artizan, and equally effective as those charged to the nobility and gentry at 14 guineas. I understand it is to be obtained, at a few shillings' cost, of Mr. Champion, Ironmonger and Bath Manufacturer, 18, Southampton Row, Russell Square.

Description of engraving.—a, the boiler; b, mouth of boiler for filling; c, stand to support boiler; d, spirit lamp; e, steam disperser, or herb box.

In addition to the above, a yard or two of cheap calico, and two hoops, such as children trundle, large enough to enclose the person seated in a chair directly over the disperser, which can easily be suspended to the ceilng by a cord, would complete the bath.

I remain, Sir,
Your obedient servant,
A Subscriber.

SOUTH AUSTRALIA.

In Adelaide the rapid progress of buildings and the formation of streets, are truly astonishing. There are now within its limits a population of nearly 4000 souls, inhabiting about 330 dwelling-houses of various descriptions—a great portion of them built of brick or of substantial stone. About one hundred acres are already under culture as gardens and orchards, in the town alone, and these are likewise fast increasing. Although the country sections have not been in the hands of the proprietors much more than four months, there are nearly two hundred acres under the plough, and promising fair to produce abundant crops during the present season. Next year there is every reason to believe that, in the neighbourhood of the town alone, at least 2000 acres will be under cultivation; and this, even in spite of the high rate of wages, and the consequent greater encouragement to embark capital in stock or sheep farming, where the expense of labour is not expensive in the same proportion.

Provisions, fresh meat, and vegetables of all sorts, are abundant, and, everything considered, at moderate prices. Beef of first-rate quality, from 10*d.* to 1*s.* per lb.; mutton and pork the same; with a certainty that the importations from Van Dieman's Land, and overland from New South Wales, Portland Bay, and Port Phillip, during the approaching season, will reduce these prices to at least one half. The rate of wages continues high; but the supply of labour in future is likely to be more commensurate with the demand, although we do not anticipate any striking or material change in this respect for some time. The common labourer, who in England was glad to escape the workhouse by earning 8*s.* or 10*s.* per week, here realizes him 30*s.* or 36*s.*, while artizans and mechanics of all descriptions earn from 9*s.* to 15*s.* a day. There are men in the colony who left England 18 months ago, *at the expense of the parish*, now possessed of real property exceeding 300*l.* in value, which they have acquired by fair and honest industry; nor is there a solitary instance within our knowledge, where good conduct and temperate habits have failed in rendering the labourer, if not altogether independent within a few months, at least in a fair way of becoming so in a few years, and of reaching, besides, a station in society which at home was altogether beyond his grasp or expectation.—*South Australian Gazette.*

This is, indeed, a fair and flattering prospect for emigrants; we are not prepared to affirm that it is not the real state of the colony, but we certainly feel it our duty to caution all mechanics who are disposed to emigrate upon speculation, not to place too much confidence in newspaper reports; so many have been misled and disappointed by erroneous and unfair representations, that common prudence must suggest the propriety of obtaining the minutest information, not only from public sources, but, if possible, from the experience of private individuals, before so serious a step is taken, as that of removing to the antipodes, with a precarious prospect of gain, and, in many cases, with the certainty of total unmitigated ruin in the event of a failure. With this admonition as a check on rash precipitation, we add some extracts from *James's Six Months in South Australia*:—"The climate of South Australia, for eight months of the year, is as fine and salubrious as any person can desire or imagine. From April to November, it may challenge comparison with the most favoured regions of the globe, and is in every respect suitable and even delicious to an Englishman's tastes and feelings. I have sometimes, in the mornings of April and May, whilst inhaling the pure and balmy air of Mount Lofty, felt a positive pleasure in mere ani-

mal existence, in the act of breathing. In these months a fire is comfortable at night and morning, and in June, July, and August, it is comfortable all day." In another passage, the writer alludes to circumstances of a more equivocal nature:—"The inhabitants (of Adelaide) may be said to live almost constantly in the open air—retain *for a long time* their English ruddiness of complexion—*appear* free from the *prevailing diseases* of New South Wales; viz., the dysentery and influenza; and *even the children*, when kept clean, a *very* difficult matter in summer, look plump and chubby." The general fineness of the weather is, however, unquestionable. "By a register kept very accurately at Government House during the whole of the year 1837, it rained 115 days, and was fine and clear 250; and this may be reckoned upon as a fair average of a series of years. In the west of Scotland it generally rains 202 days, and is fine only 163, and many of these days are lowering, with the sun obscured, so that the comparison in this point is very much in favour of South Australia." And so it had need; a Scotchman has no particular aversion to travelling a little way towards the south, but he will ponder well before he leaves the land of "honest men and bonny lasses," to go so far south as this, without stronger recommendations than the climate being better than that of Scotland; especially as it is so hard to get "bock again." We conclude with one more extract from the same work:—"It was pleasing to see in Adelaide the importance and respectability of the labouring classes. * * * There seemed also a freshness and gentility about the females of South Australia, contrasting very favourably with the rubbish of Sydney; and a person coming from the eastern colonies, would not fail to be struck with the superior ruddiness, simplicity, and purity of the South Australian damsels."

An Agency Office is established, No. 5, Adam-street, Strand, where much information may be obtained relative to South Australia, and a variety of works on the subject are there for sale; we also recommend a monthly stamped publication, "The South Australian Record," which usually contains a variety of accurate and valuable information.

VALUE OF THE FRENCH METRE.

To the Editor of the Mechanic and Chemist.

Sir,—I am led to address a few words to you upon the value of the *metre*, from noticing considerable discrepancies among writers as to the equivalent French and English measures of length. Reynaud, in his edition of *Berout's Arithmétique*, and Feyssèdre in his *Notions Elémentaires*, give data for calculation which produce very different results. Mr. Horry, in his translation of *Bertrand's Revolutions of the Globe*, nearly agrees with Feyssèdre; while in *Silliman's Journal of Science*, Vol. XXI., I find a value given to the metre which coincides with your own in No. XII. of the *Mechanic*. The Abbé Périn, in his *Histoire de Russie*, says, that 16 English feet are equal to 15 pieds-de-roi, or old French feet; but this must be in round numbers, as the result thus obtained exceeds all the others, even at the lowest calculation. The values of the metre in English feet, according to these authorities, are as follows:—

Périn	3·2836679
Reynaud	3·2819167
Mechanic	3·2808992
Silliman's, J. ...	3·2808992
Feyssèdre	3·2798258
Horry	3·2798250

It seems to me, from comparing two or three astronomical quantities, and taking a mean, that the third of these values is the most correct. Perhaps, however, you can set this point at rest in a more satisfactory manner; meantime it is not unimportant that such differences should be known to exist.

I am, Sir, yours truly,

C—s C—r.

[The value we gave, though agreeing with that given in the Journal of Science, was not derived from that source; but we believe it agrees, or very nearly so, with the most recent tables. Our correspondent is fully aware of the difficulty of measuring a terrestrial degree with that precision which would give the metre, derived therefrom, correct to the seventh decimal place. The most convenient method of fixing a standard for measure, is, perhaps, the oscillation of a pendulum; if our measure were taken 39·2 inches equal to one second, in this latitude, and *in vacuo*, it might at any period, be easily recovered by that indication.—Ed.]

RAILWAY MISERIES,

The following account of railway "miseries," taken from a sprightly article in *Blackwood's Magazine* for April, has been going the round of the anti-railway press during the week. The extractors appear not to have seen that the writer is making game of the frivolous objections urged against the new mode of travelling:—

"I hate railroads. Any one else may love railroads, or like railroads, or praise railroads, but I hate railroads. I hate to be obliged to arrive at a railroad-office a quarter of an hour before starting. I hate to be obliged to go and stand between certain pieces of wood, nailed across and along, to ask for a place. I hate to be made to go in at one end and out at the other, just as if I had already commenced my imprisonment, and as though the turnkey had fastened down upon me all his iron, steam, and coals. I hate to see all my luggage and baggage taken from me, and placed *malgré moi* on a stone pavement, quite naked and unprotected; boxes, trunks, shawls, ruffs, books, umbrellas, maps, sandwich-boxes—all in one hurley-burley; and then to be told that I may go and claim my luggage, and arrange my luggage just as I like. I hate to have to do with parties who never touch their hats, and who cannot be civil, because you are forbidden to give them a silver sixpence. I believe the fellows have not even any pockets in their breeches, lest a stray shilling should by chance find its way into them. I hate to be made to wait for a steam-engine, and for a steam-engine never to wait for me. Horses will wait, and men will wait; and even sometimes, when you are young and handsome, or old and wealthy—or neither, and very agreeable (precisely my case), women or ladies will wait for you (aye, and the Lancashire witches too). But a steam-engine will not wait; for all its enjoyment appears to consist in rattling away as hard as its lungs will admit, from Dan to Beersheba, and from London to Jericho, without so much as kissing its hand to the nymphs and maidens on the road."

If nine-tenths of the would-be influential brawlers against railways were called upon to produce reasons for their "hate," they would give an equally rational, though perhaps not half so witty an account. At the bottom of much of their hospitality lurks a feeling of offended dignity. They "hate to have to do with parties who never touch their hats;" they hate to be reduced to a level with the commonality; to have neither more nor less "civility" bestowed upon them than upon the multitude; to be in fact looked upon as nobodies in a crowd, whom neither coachman nor guard, neither Boniface nor Boots will, for the sake of "a silver sixpence," deign to honour as in the good old times of turnpike roads and midnight suppers *en route*. Hence so many complaints of rudeness on the part of railway servants, who fail to bestow on provincial *pomposos*, and conceited cits, the accustomed marks of homage "with 'bated breath and whispered humbleness." — *Railway Times.*

LOCOMOTION SIMPLIFIED.

We have had the pleasure of inspecting, at Messrs. Barton's coach-manufactory in Milk-street, Bristol, a carriage which may be said to be almost self-acting, its motion being obtained from the rider's own weight. In construction, it is peculiarly light and elegant, and on mechanical principles, beautifully adapted to the object sought to be obtained. The rider's seat is a saddle, and the only effort he is required to make for the rapid propulsion of the vehicle, is the easy motion used in a trot on horseback. The result of a trial of its capabilities on Durdham-down and the Stapleton-road, fully proves that great velocity may be easily obtained on a level road. On a slight descent, twenty-five miles per hour may be traversed, without danger; and to ascend a hill, very little exertion is necessary: some must, of course, be used; for even the powers of a steam-carriage are taxed to accomplish an ascent. A vehicle which, from a description we have read, appears to be somewhat similar, has recently been exhibited in London; and we suppose it is this announcement which has induced our fellow-citizens to complete their carriage on an invention which originated with them several years ago.—*Bristol Journal.*

[Judging only from the above description, we should pronounce this machine to be far inferior to that of Mr. Ritchie, described in our last number; but inventions of this kind should be seen, and even tried, before they can be correctly appreciated.]

FRENCH VANITY.

The following is a literal translation of an article in the Paris Journal, "Le Temps:" — "On the table of the President of the Academy of Sciences, was remarked a bronze and gilt inkstand, in the style of Louis XV., which artists call "*genre rocaille*" (a kind of grotesque scroll). The covers were surmounted by three crowns, and a multitude of escutcheons indicated that it was destined for a royal cabinet. We learn, that the Piedmontese engineer, who is the author of it, means to present it to the Emperor of Austria. This inkstand, besides the luxury of its decorations, contains a learned piece of mechanism, by means of which, a dial, placed on the su-

perior surface, shows the hours, and their subdivisions, the days, the months, and the years. *No doubt, before offering it to the Prince, the au'hor has desired that his invention should be sanctioned by the Institute, which acts in Europe the grand part of a sovereign court, judging without appeal th' scientific discoveries of the whole world.*" This last effusion was never exhaled from *soupe maigre*, and bottled swipes. "No doubt," the illustrious writer had been regaled with some of the nobler French dainties—boiled bread and butter, mashed dandylions, or fried frogs.

BLASTING OF ROCKS, &c., BY THE GALVANIC FLUID.

To the Editor of the Mechanic and Chemist.

Sir,—A gentleman, of the name of Martyn I. Roberts, has lately applied Galvanism to the above use. The priority of the invention, I am inclined to think, does not belong to that gentleman; but the priority of *application*, to that particular purpose, most certainly *does*. The benefit that will be derived from this method must be very obvious to persons at all acquainted with the very great danger attending the usual mode of blasting rocks with a fuse, the method of which (as possibly some of your readers are unacquainted with it) I will give a brief account. A hole is bored in the rock to be blasted, about seven inches in depth, and two inches diameter, into which gunpowder is placed, until within two inches of the top. A fuse, *calculated* to burn about a minute, is then inserted into the gunpowder, and the remainder of the hole filled up with coarsely-pounded granite (called temping), rammed down tight. The very act of ramming is dangerous, as a spark is sometimes elicited. Sometimes the fuse burns too rapidly, not leaving the men time to get away. Sometimes it hangs fire, and, after a length of time, the men return to insert a fresh fuse (thinking the old fuse extinguished): just as they reach the place, it explodes, and either kills or wounds them severely. At another time, it goes out altogether. Now by the method used by Mr. Roberts, these dangers are entirely done away with. The hole is bored in the usual way, and the gunpowder inserted; a piece of fine platinum wire is fastened to the ends of two long copper wires, and placed into the gunpowder; a piece of wadding is rammed down, leaving a space of about two inches between it and the powder,* and the remainder filled up with sand. Connection being then made with the battery, by means of the copper wires, the platinum wire becomes red-hot, and inflames the gunpowder. If there be any defect, and the powder does not explode, break connection with the battery, and the cause may be examined into without the *slightest danger*.—I remain, Sir,

Your obedient servant,

O. Z.

Kennington Road.

* The expansion of the air causes the violence of the explosion to be much greater.

Voraciousness of the Eel.—While one day standing on the low edge of rock, enjoying the delightful scenery of the Tay, I witnessed a very striking, and, so far as I know, novel exhibition, touching natural history, being nothing less than a chase upon terra firma of a crab by an eel, and illustrative, in a remarkable manner, of the eagerness with which the latter animal pursues its prey. My attention was drawn to the spot by a rustling sound, when I saw the fugitive in the act of emerging from the water, the eel, of large dimensions, soon followed. After promptly effecting a landing on the rock on which I was standing, which both of them did with great dexterity, the crab took to his eels with all manner of dispatch, and soon showed his pursuer the advantage of the possession of a supply of limbs. The eel, however, nothing daunted, although labouring under the primeval curse of a serpent, dashed after him with the utmost eagerness; but it was soon obvious that the locomotive machinery of the latter was dismally at fault. He wormed, twisted, and oscillated himself to and fro to comparatively little purpose, although in this way he kept up the chase for a considerable distance, until at length, on my approach, both of them made a short cut, and got again into the water.—*Cheltenham Chronicle.*

To make Names grow in Fruit.—When peaches and nectarines are about half ripe, cover the side exposed to the sun with strips or specks of wax, in any desired shape or form, which hinders the sun from colouring the parts covered, and when the fruit is ripe and the wax removed, it will be found marked in the manner desired.

Fumigating Powders.—Take of cascarilla, reduced to a coarse powder, camomile flowers, and aniseed, each equal parts, two ounces. Put some hot cinders in a shovel, sprinkle this gradually on it, and it will take off all offensive smell, and keep off infection.

THE CHEMIST.

ELECTRICITY.

NO. III.

(See engraving, front page.)

THE rubber of the electrical machine, as described in my last paper, produces but trifling effects of itself; it is, therefore, covered with a composition called the amalgam, which greatly increases its power. Various recipes are given by different authors for making it; that recommended by Singer, which I always use myself, consists of two ounces of tin, and four of zinc, melted together; when cold, add seven of mercury, and then melt them again; stir this well with an iron rod, and when cold, pulverize it finely. When wanted, mix a little with sufficient lard or tallow to form a stiff paste; spread this over the surface of the rubber, and turn the machine for some time, so as to cause the grease to rub off on to the cylinder, which should then be wiped clean. The machine being now ready for action, must be warmed, and all dust and moisture carefully removed by wiping. When turned, the rubber appears covered with a beautiful blueish light, and sparks or lines of light dart from it under the cylinder to the conductor, whose points appear illuminated in the same way. If the knuckle, or a brass ball, is now brought near the conductor, a bright spark will pass from it to them. If the Leyden jar be placed in the same manner, either by holding it in the hand, or by placing it on the table, sparks will pass to it, and by holding it with one hand, and applying the other to the ball at its top, the shock will be felt in the arms and across the chest, if sufficient electricity has been accumulated in the jar. Similar results occur if the chain (which I should have mentioned as being fixed on a ball connected with the rubber, and touching the ground) is transferred to the conductor and the jar, &c., applied to the rubber. When I speak of the conductor, I mean that one which is armed with the points; properly speaking, both it and the rubber are conductors, the rubber being the *negative*, and the other the *positive* conductor: the meaning of these terms I shall explain at a future time. Brevity is my only reason for using the term conductor in its present restricted sense.

3. If a wire or other conducting substance is made to connect the two conductors, it will be found impossible to obtain a spark while they are thus united.

4. If, instead of the wire, a silk thread (a non-conducting substance), having a number of small shot closely strung upon it, is made the medium of connexion, sparks will appear at the intervals between them; but in other respects it acts the same as the wire. The appearance produced in this experiment, is caused by the passage of the electricity from one conductor to the other; a spark appearing at every place where the conducting medium is broken, the electricity having then to pass through the air to the next conductor.

5. If we paste a slip of tinfoil a quarter of an inch in diameter round a glass tube in a spiral form, and then divide with a pen-knife in the form of the letter X, picking out the two conical pieces of foil, a small interval is left in it; where these divisions occur, a bright spark appears. If this is done all round the tube, it produces a very pleasing appearance. It is frequently called the diamond necklace.

6. Paste a slip of foil backwards and forwards on a slip of glass, and wherever the letters cross the foil, divide as in the last experiment, and fix a ball on the upper end of the glass, hold the lower one in your hand; when sparks are drawn from the machine, the word appears in a very pleasing manner. (See sketch in front page.)

Having now noticed some of the principal phenomena of the machine, I will proceed to treat of the theories which have been brought forward to account for them. The first of these was that of Du Fay, who finding, as I before stated, that the electricity evolved from sealing-wax, neutralized that of glass, supposed that all bodies which were capable of being rendered electric, contained both these kinds of electricity, that their excitement was caused by the abstraction of one kind according to the nature of the rubber, and their neutralization by their re-uniting together. Such was the opinion of philosophers on this interesting subject, until the immortal Franklin first began those experiments, which soon led him to frame a theory far more consistent with the simplicity of nature, and also by his sublime attempt in questioning the heavens themselves, to raise his favourite science from a mere object of curiosity, to one of the most important subjects of philosophical research. He found, that if we suspend a jar by its knob from the conductor of the machine, or support it on an insulating stool, so as to cut off its connexion with the earth by its exterior coating, that but a very small charge could be given to it; but while in that condition, if the knob of a second jar were brought in contact

with its outside, and its bottom resting on the tube, sparks passed from it to the second, and both became thoroughly charged with the same number of turns of the machine that the first alone would have required. While in this state, he found that if a wire were brought in contact with the outside of the second jar, and carried to the knob of the first, the explosion took place, and both jars were perfectly discharged. From these and other experiments he concluded, that electricity exists in all natural bodies; but that some of them attract it with much greater force than others; consequently when two of them are excited by friction together, or other means, the one abstracts a portion from the other, and becomes what he calls *positively* electric, while the one which has become deficient, he terms *negatively* electric; both of them exhibit electrical effects, the one in endeavouring to distribute the electricity it has acquired, and the other in attempting to obtain that which it has lost from surrounding substances; hence the attractions that have been before mentioned.

ELECTRON.

WARM CAVERNS AT MONTELS, NEAR MONTPELLIER.

M. MARCEL DE SERRES has addressed to the French Academy the results of his observations on the high temperature of these subterraneous cavities. One of the English philosophers, who have directed their attention especially to the subject of the increase of temperature with the depth of the cave, having affirmed that he had constantly obtained a greater increase of temperature, by placing his thermometers in the interior of rocks, M. Marcel has endeavoured to ascertain if the same effect could be observed in the caverns above mentioned. For this purpose, two cylindrical holes, large and deep enough to receive the thermometers, were pierced, one in the left chamber situated towards the north-west, the other in the chamber on the right, which is towards the north-east. The thermometers placed in these holes in July, were not removed till the 11th of August following. During this interval, care was taken that no one should penetrate into the caves, which are closed by an iron grating. The thermometer on the left, at the moment it was withdrawn, marked $+22^{\circ}{\cdot}55$; being afterwards placed upon the red clay which fills the fissures of these caverns, it immediately began to descend, and finally remained at $+21^{\circ}{\cdot}59$. The thermometer on the right was soiled, and could not be read soon enough to indicate the true temperature of the hole; nevertheless, when it could be seen, it marked one-third of a degree above the temperature of the red clay.

To Gild Edges of Books.—Take the white of one egg, beat it up in nearly half a pint of cold water: put the paper to be gilt between a pair of bevel-edged boards after it is cut; screw it up in a cutting-press very tight, then mix a small quantity of bole ammonia; with a little water, and rub it over the paper edges to be gilt; then take a handful of paper shavings, and rub it off perfectly dry; then take of the size prepared from the egg, and lay it on the paper; cut some pieces of paper a little larger than your gold leaf and rub them on your hair, which will cause them to adhere to the paper, from thence to be transfixed to the paper already sized; when dry, burnish off with an agate burnisher. To tell when it is dry, breathe on it, and if the breath flies off quick, it is right.

A. B.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, April 24, C. Johnson, Esq., on Botany. Friday, April 26, Robert Addams, on Chemistry. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, April 23, R. Guthrie, Esq., on the Rights of Woman. At half-past eight.

Poplar Instiiution, East India Road. Friday, April 23, Mr. Holland, on the Tides. Thursday, April 26, Discussion.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, April 25, Nathaniel Rogers, M.D., on the Mythology of the Ancients. At eight o'clock.

QUERIES.

To the Editor of the Mechanic and Chemist.

SIR, Can you or any of yonr numerous correspondents inform me of the best method of painting wire-blinds, and what sort of paint is used for them? R. S. G.

SIR, I shall feel much obliged if any of your correspondents, who are practical assayists or chemists, can inform me the best mode of separating the speltre from old metal; and also if they will give me a cheap composition, or cement, to work into moulds yet tenacious?

C. LAUNDET.

SIR, Can any of your numerous readers inform me of the best and cheapest method and materials for making paste and liquid blacking, but particularly the former?

J. R. ALMORE.

SIR, Can you or any of your numerous correrespondents inform me of a method of preparing a good black varnish, or where it can be purchased? P. T.

SIR, Will you or any of your numerous subscribers inform me of the best composition and

method to silver brass wire, such as is used by instrument makers? Also, what is the article now used for cleaning red gloves, so that there is no unpleasant smell arising from the turpentine, which formerly was the chief ingredient; and if there is any method of depriving turpentine of its smell without injuring its properties? These questions are not asked with a view of making a profit by them in trade, but for private purposes.

A. B.

Sir, Can you or any of your readers inform me of the principle feature in Moor's newly-invented life boat, as he states there will be no more boilers bursting, as in the Victoria steam ship? I likewise beg to call the attention of your correspondents to the following queries:—How to prepare turkeys' maws? How to prepare phosphorus, chlorate of lime, nitrate of strontia, and nitrate of baryta? Also how to prepare indelible checks for the garden?

R. S. L.

Sir, Can any of your readers inform me of the articles used in making red sealing-wax, with the quantity of each, and the manner of drying it? Also the cheapest place to buy small lead type, with the price of them.

James Lee.

7, Globe-lane, Mile-end.

"Erasmus," in No. 112, refers "A. A. A." to Partington's Cyclopœdia for the preparation of coloured fires; as I do not possess that work, nor know a friend who does, may I request the favour of him to forward you a copy of the various coloured fires he may there find described.

F. E. L.

Sir, By what method can the carbon be extracted from the carburetted hydrogen, in order to leave the hydrogen pure, or nearly so? Is the decomposition of steam in a heated tube, an economical mode of procuring hydrogen?

F. E. L.

Sir, Can you or any of your correspondents inform me the best way of staining the air of a brown or auburn colour? Also, how to make a silver tree? How to take fruit stains out of linen, muslin, &c.? How to prepare citric acid? How to make oil unite with water? How to make copal varnish?

P. Truman.

ANSWERS TO QUERIES.

Sir, In answer to "Coles," I beg to inform him that the pot batteries are by far the best in use, and in every respect superior to the troughs, being cheaper, more simple, and less expensive to charge them, and when they are charged, will keep up their power ten times longer, if properly made; and I also beg to inform your very numerous correspondents, that we can supply them with batteries of every kind, with the latest and best improvements, and electro-magnetic apparatus of every description, at prices which will place them within the reach of every one; and persons wanting materials of any kind can have them at the lowest possible prices. A battery is always kept in use, which any of your readers are welcome to inspect at any time.

Poole and Son.

124, Wardour-street, Oxford-street.

Sir, A "Constant Reader," whose communication appears in No. XI. (New Series), can easily tell the extent of surface which a wheel travels over, if he knows the number of revolutions made by it in a minute. Circumference $\times$ number of revolutions $\times$ the time in minutes $=$ extent. The wheel in each revolution generates a cycloid, the line subtending which is, of course, the space passed over; and this can be demonstrated to be equal to the circumference. A "Constant Reader" must make due corrections for stoppages, and for alterations in velocity.

C—s C—n.

To Mix Oil with Water.—In answer to your correspondent "E. C.", Commercial-road East, it is not possible to mix oil with water to be of any use for the purpose of painting. If you wish to combine the oil with water, you must use an alkali, such as sub-carbonate of potash, and when you have done that, you will have a soapy compound that will not dry for a length of time. The only way that I know of for working colours as a substitute for paint, is vellum or glue size; but that will not do for out-door work, without varnish.

A. B-

TO CORRESPONDENTS.

C—s C—n. *His letter has not been intentionally delayed; we will endeavour to find it, and every attention shall surely be paid to it.*

W. H. *We must decline inserting his letter for two reasons; first, because his expatiation throws no light whatever upon the problem of "A. Z." and, secondly, because his uncivil remarks would lead to unprofitable and angry discussions, and expose "W. H." to such a broadsider, as would unfit him for the sea of literature for six months to come. The admirable instrument for trisecting an angle, a description of which we gave some time ago from a correspondent, was properly and minutely described. If our correspondent is acquainted with any person who understands geometry, he may assist him* (W. H.) *in understanding it; but we cannot go over the demonstration a second time, after it has been so ably done by our correspondent* "Ratio."

H. Bowler's *solution of* "A. Z.'s" *problem will be inserted as soon as the diagram is ready.*

Luna *will perceive that we have already given a description of the method of gilding the edges of books. For the information of* "S.", *we will add* "Luna's" *method, as it differs in some points from the other:—"A composition of Armenian bole and sugar-candy is to be ground together, and is then to be laid on while the book is between the press, with a brush, and white of an egg; this coating, when nearly dry, is smoothed with a burnisher; it is afterwards slightly moistened, the gold leaf applied, and burnished."*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); and published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

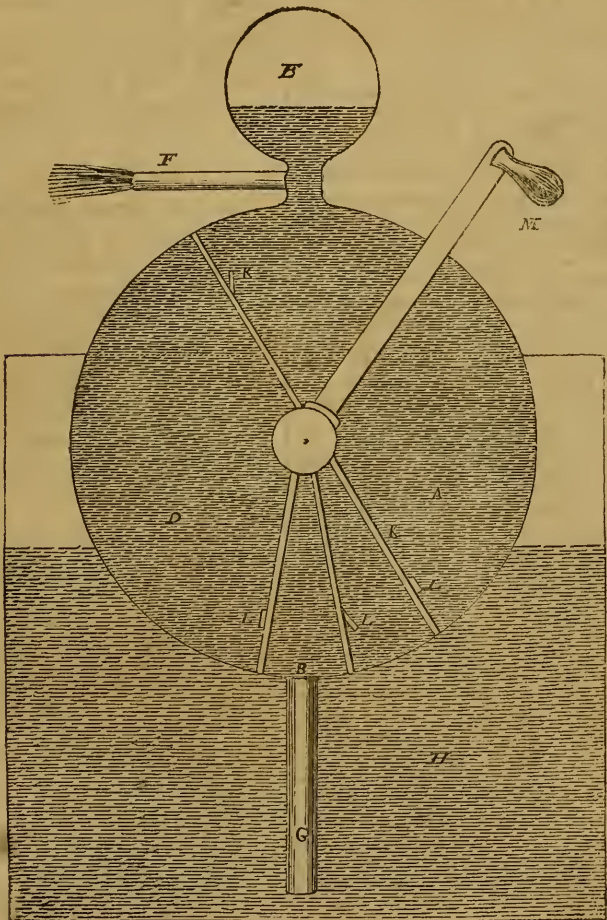
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XIX. NEW SERIES. | SATURDAY, APRIL 27, 1839. (PRICE ONE PENNY.) | No. CXL. OLD SERIES.

SCHMIDT'S PORTABLE FIRE ENGINE.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

SCHMIDT'S PORTABLE FIRE ENGINE.

(See front page.)

This engine, invented by Mr. Schmidt, of Zurich, is intended to be kept constantly filled with water in an apartment, so that it may be brought into action immediately upon the discovery of a fire; the simplicity of its construction admits of its being made light enough to be carried by one man, with a considerable quantity of water in it. Its power is very great, and the inventor assured us that he could with ease project a jet of water to the height of forty feet. D A is a hollow cylinder, in the form of a thick cheese, with an aspiring tube, G, immersed into the water contained in the vessel, H; there are two plates of metal, reaching from the circumference to the centre, fixed to the two flat surfaces, and likewise to the cylindrical rim, so that there can be no communication between the water contained in the space, B, and the other part of the cylinder, except through the valves, L L, opening outwards from B into D A. There is also a plate of metal, *k k*, reaching entirely across the cylinder, and moving about the centre by means of an axis, which passes perpendicularly through the two flat surfaces. A lever, M, is attached to the protruding part of the axis, and by turning this lever, the water is forced through the exit pipe, F, to which a flexible tube is attached for the convenience of directing the jet to the place where it is required. E is a hollow ball, in which the air is compressed when the water is forced upwards, and by its elastic force, sustains a uniform pressure. In the engraving, the lever, M, is represented as being moved towards E, consequently the lower valve, K, is closed, and the water is aspired from B, through the open valve, L, into C; the water contained in D being compressed, closes the valve, L, which communicates with D, and opens the valve, K, which admits the water D into A. By reversing the motion of M, the same effect will be produced on opposite sides, the valves which are now open being closed, and *vice versâ*; so that by continuing to move the lever, M, backwards and forwards, a continued jet will be projected from F, with a force proportioned to the force applied to the lever. We recommend this engine to the attention of our mechanical readers, highly approving its principle, and believing it to be entirely new in England.

ON THE RAYS OF LIGHT IN WATER.

To the Editor of the Mechanic and Chemist.

Sir,—The singular fact reported by "J. B." in No. 15 of your useful publication, afforded me the more pleasure, as I think I am able to trace the appearance of the luminous radii which he describes, to a cause very similar to that which gave rise to visible rays in the beautifully coloured water of a Swiss lake. It does not seem doubtful that the appearance in question was formed, as supposed by "J. B.", by the light of the sun *beneath* the surface of the water; and as the weather was clear, and the water probably transparent, the only circumstance difficult to be accounted for is, that the light, instead of being general, should be confined to the immediate vicinity of the shadow. I will first consider this circumstance, and next, to what cause may be attributed the radiating form of the light.

It is probable, notwithstanding the great transparency of water, that light may be thrown back more abundantly by its colouring particles in the direction of their arrival, than in a lateral or oblique direction; and as the position of the shadow with regard to the observer, is identical with the direction of the light which causes it; it is in the immediate vicinity of this axis, that the greatest quantity of light would be sent back to the eye by strata of colouring matter of an indefinite depth, forming thus a column more luminous than the other parts of the fluid.

As to the radiating lines so clearly illustrated in the plate, I am inclined to think that they must be the result of the undulations of the surface of the water, which, by acting in the manner described in No. 11, would divide the light into separate streams, which if the surface of the water presented, on the contrary, but one plane, would penetrate into it everywhere with the same intensity, and would give to the luminous circle round the shadow of the observer, an edge equally diffused in its whole circumference, instead of being radiated. The effect of perspective might alone suffice to render rays vertical and parallel to each other, horizontal and concentric in appearance.

If the phenomena in question have only been observed at sea, I attribute this circumstance chiefly to the want of depth, or limpidity of rivers, whose turbid beds throw back a quantity of light that disturbs those more delicate results, which are rendered apparent by the dark and uniform ground presented by waters of

fathomless depth. The presence of salt in water, by rendering it denser, might increase its refracting power, but to what degree, I have no means of ascertaining.

I have no doubt but "J. B." will take it in good part, if here I beg to observe, that instead of giving us a representation of his shadow, as expressed in the text, he has introduced himself, as may be seen by the rim of the hat and other details shown on the superfices of the figure. and not on the edge alone. Perhaps this may have been done intentionally, in order to add to the picturesque effect; and "Mr. J. B.", looking over the side of the ship, is certainly a more agreeable portrait than an insignificant outline filled up with blank shade, though it must still be lamented that he could not be turned the other way.

Yours, Sir, most respectfully,
A SUBSCRIBER.

BLASTING OF ROCKS.

To the Editor of the Mechanic and Chemist.

SIR,—I was highly gratified to see in the last number of your very useful "Mechanic," (which I have been in the constant habit of reading from its commencement), a paper upon the above subject, signed "O. Z." In confirmation of his remark, "the benefit that will be derived from this method must be very obvious to persons at all acquainted with the very great danger attending the usual mode of blasting rocks with a fuse," I will, with your permission, Mr. Editor, mention a circumstance which I witnessed some years ago, whilst on a visit in Devonshire.

Taking a stroll with a friend round under the cliffs at Plymouth, our attention was directed to the workmen employed in blasting the huge fragments of rock which hung over our heads. One man in particular attracted our notice; he was working upon an apparently very small projection of the rock, at a distance of little, if any, less than 200 feet from the ground. Having made an incision in the cliff sufficiently deep to answer his purpose, he charged the rock with gunpowder, in the manner described by your correspondent, from a flask with which each labourer is supplied. Having done this, he struck a light, gave the usual signal to his fellow workmen to withdraw, and, lighting the fuse, made a speedy retreat to the top of the cliff, near to the surface of which he was working. After waiting five minutes, instead of one or two, the time at which the powder generally takes effect, he was in the act of returning to place another fuse, when the powder went off with a tremendous explosion, carrying fragments of the rock to a most fearful height. The place on which the man had previously stood was blown to atoms, so that had not the powder ignited as it did, he must have suffered a most frightful death, being either mutilated by the scattering rock, or, falling to the earth, been dashed to pieces.

I am, Mr. Editor,
Yours respectfully,
AN OLD MAN.

LOCOMOTION.

MACHINES MOVED BY MEANS OF COMPRESSED AIR.

M. PELLETAN has written to the French Academy to establish the fact, that on the 10th of July, 1838, he solicited and obtained a patent for the application above mentioned, of compressed air. The following passages in that letter appear worthy of attention:—A decimetre cube or litre of air, compressed to the amount of ten atmospheres, will exert a force of 300 kil. (about 600 lbs.) through a space of one metre: ten litres will therefore give 3000 kil., and dispensing these ten litres by the second, the theoretical power of 40 horses will be obtained.

Let there be a reservoir of wrought iron, proved to the pressure of 20 atmospheres, 2 m. 8 in. diameter, by 6 metres in length; its capacity will be equal to 36,000 cubic decimetres; the air, being compressed to 15 atmospheres, will furnish 10 litres per second during an hour with an elastic power, varying from 15 to 5 atmospheres, which is equivalent to an average tension of 10 atmospheres. Reducing to one half, the available power of 40 horses, a reservoir of the above dimensions would be sufficient to propel a train upon a railway with the force of 20 horses, and a speed of 30 miles an hour; it will, therefore, only be necessary to replenish the air in the reservoir once every thirty miles; this is to be done by means of fixed engines placed along the road. In this system, as M. Arago observed, the pressure of 15 atmospheres need not create any apprehension of the reservoir bursting; for though it would be impossible to employ so great a pressure in a vessel exposed to heat, yet, as no cause of deterioration exists, it may be operated with safety in this case. M. Pelletan suggests the substitution of tubes of eight inches diameter; this apparatus, containing the quantity of air before mentioned, would weigh 5000

kil. instead of 2000. The great practical difficulty in this system, is the adjustment of the pistons exposed to so enormous a pressure. M. Pelletan proposed to adopt a rotatory engine, a notice of which will be given in our next number. It is also exceedingly inconvenient that the power, instead of being uniform, should vary from 5 to 15; but if other objections are removed, a remedy may be found for this inconvenience.

PROPOSED RAILWAY FOR PEDESTRIANS.

To the Editor of the Mechanic and Chemist.

Sir,—Accidentally opening the volume of your excellent publication for 1837, I see that Mr. H. Baker, one of your correspondents, proposes land skates to be made, having a single row of small brass or iron wheels running along the bottom, half embedded in the wood. May not a slide be employed similar to that of the square cedar pencils used by carpenters? I have long been of opinion, that some such apparatus would readily convey an individual on a smooth surface at a very rapid rate, and with very little effort.

Now, if there were two places between which there was a considerable intercourse, as between Glasgow and Paisley, or Bath and Bristol, and a railway on the side of the road,—of course, on a very small unexpensive scale,—should be laid down; I should think it probable that, with such a pair of sliding shoes as I have described, a person might bound along the line almost as swift as an arrow.

If anything were wanting to give an impetus occasionally, up a rise, or a hill of any eminence, a piece of rope attached to two posts here and there, would be all, I think, that would be necessary. The road in many, or in most cases, might be formed each way of a series of inclined planes; as the transition from one to another may be made with the greatest ease in an instant, and the expense might be met by a trifling charge to the travellers. Where inclined planes could be employed, of course no impetus would be wanting, as the weight of the individual would be amply sufficient. I am sure the scheme is worth a trial, and I cannot but think that there is every prospect of entire success.

Having, Mr. Editor, looked into some of your labours, I think that mechanics' institutes would do well to encourage the circulation of your very cheap and useful publication among their members, as a work eminently calculated to create and gratify a taste for science, which cannot but be in a high degree beneficial to the advancement of the best interests of mankind. Heartily wishing you success,

I am, Sir, yours, respectfully,

B. H. D.

P.S. The scheme would not do without a railway, as no level surface could be found for any extent; I mean so as to be of any value.

Southampton, April 20, 1839.

PLAN TO PREVENT CONCUSSION ON RAILWAYS.

To the Editor of the Mechanic and Chemist.

Sir,—I am of opinion that if a carriage, with a pair of inclined rails fixed firmly on it, were attached to the last coach or waggon in the train, it would prevent any accident from concussion, which so frequently occurs at present, by another train in the rear coming suddenly upon it. The inclined rails might be made to traverse the fixed rails with great exactness by having wheels of small diameter at the base. Should a train approach with great velocity upon another in advance of it, the engine of the former, instead of coming with a tremendous crash against the buffers of the latter, would ascend the inclined plane, which should also have buffers fixed at the top: by the time the engine had made its ascent it would nearly have spent its power, and the foremost train moving forward at the same time, would bring the engine again on the permanent rails. The engine and tender could be easily so arranged as to prevent any concussion when the former assumes its inclined position. Objections might be started against the above plan, on the ground that the water in the boiler would be suddenly thrown out of its level position, and come in contact with over-heated parts, thereby causing an explosion; but tubes being used in locomotive engines, I think there is little danger to be apprehended from that, especially as common-road steam-coaches have nearly the same obstacles to surmount.

I remain Sir, yours obediently,

H. P.

[The danger to be apprehended from one train overtaking and striking against another is when some impediment has caused the foremost train to stop; in this case, were our correspondent's apparatus in operation, the consequences would be frightful; for a train, moving at the ordinary speed, would drive the engine over the first carriage it came in contact with, and probably crush, not only that, but

others beyond it, owing to the obliquity of the engine's descent, after its projection, and the continued action of the train behind. The suggestion we believe is new, and it is ingenious in itself; we therefore present it to our readers, with the hope that some application of the principle may occur, either to the inventor or to some other ingenious correspondents, which would render it available for some useful purposes.—Ed.]

REVIEW.

C. Carter's *Discount and per Centage Tables; showing the amount of per centage from* $1\frac{1}{4}$ *to 50 per cent, and from one penny to one pound.* London: Simpkin, Marshall and Co.; and C. Carter. 1839.

The plan adopted by the author of these tables differs from the usual construction, and we do not hesitate to recommend them as accurate and convenient for reference.

The first column in each page is the per centage, from $1\frac{1}{4}$ to 50; and in the following columns, under the heads of the different sums, from one penny to one pound, increasing one penny in each succeeding column, are the amounts of per centage or discount on the different sums. The advantage of this arrangement is evident; for it not only gives the amount of per centage at a given rate, but it also shows the rate of per centage represented by any given sum. Suppose, for example, it were required to add 6d. to 6s. 8d., and you wish to know the rate of per centage represented by the 6d., refer to the column headed 6s. 8d. and the amount, 6d. will be found opposite $7\frac{1}{2}$ per cent. When the exact sum does not occur in the required column, two sums, making together the required amount, may be taken, and their respective rates, added together, will give the proper answer. The author says, in the introduction, "There is one important circumstance to be noticed, that is, in not being deceived as to the rate of per centage on the returns. To gain a profit on the selling price, the per centage should be placed on it: for instance, if an article costs 1s and it be required that $17\frac{1}{2}$ per cent. profit should be obtained on the returns, first find out in the page of the amount of 1s., and $17\frac{1}{2}$ per cent. on 1s. is 2d.; but this is merely the common rate of per centage on the selling price. You must, therefore, add 2d. to the cost, making, together, 1s. 2d.; then, in order to come at the real per centage, look for $17\frac{1}{2}$ on 1s. 2d., which will be $2\frac{1}{2}$d. This, then, is the actual amount of $17\frac{1}{2}$ per cent. on the selling price, so as to leave the cost unimpaired, if the same rate of discount was to be taken off. (As to Rule.)

FIRST RULE.

Selling price	£0	1	$2\frac{1}{2}$
$17\frac{1}{2}$ per cent. discount off .	0	0	$2\frac{1}{2}$
Cost, unimpaired .	0	1	0

SECOND RULE.

5 per cent. on 50*l.* is 2*l.* 10s.; but to gain a profit of 5 per cent. on 50*l.* it should be thus:

Cost . .	£50	0	0
5 per cent, on 50*l.* .	2	10	0
Ditto on 2*l.* 10s. .	0	2	6
Ditto on 0 2s. 6d.	0	0	$1\frac{1}{2}$
	52	12	$7\frac{1}{2}$

This will allow 5 per cent to be taken off, leaving your cost (50*l.*) unimpaired."

Brevity is always desirable when it can be combined with accuracy and other essential objects; the little book before us has an indisputable claim to this advantage, and we shall be glad to find that the author's useful labour is neither disregarded nor unrewarded.

Photogenic Art.—By placing an etching on a *smoked* glass (not having a resinous ground) behind an *aplanatic* lens, the smoked side towards the focus, a copy of the etching *reduced* on any required scale, is obtained. By exposure to a solar beam radiating from the focus of a lens, the scale may be enlarged. The reducing process, on trial, succeeded perfectly, only a little care is required to follow the sun. By the use of highly sensitive paper, this inconvenience would be much diminished; and, by attaching the whole apparatus to an equatorial with a clock, it would be entirely removed. If a resinous ground is used, the etching must be afterwards varnished or gummed, to destroy the loose light refracted obliquely by the thin edges of the cut-up ground, which is never quite opaque."—*Extract of a Letter from Sir J. Herschell.*

Horse's Power.—This term, used as the name of a measure of power, is an expression which has had its origin in convenience; but as the value of mechanical power became better understood, an exact measure, nearly coinciding with the power of a horse, and uniformity in the practice of engineers, became desirable. Mr. Watt has fixed the elementary horse power at 1,980,000 lbs. raised one foot per hour, or 33,000 lbs. raised one foot per minute, or 550 lbs. raised one foot per second.

MOUNT VESUVIUS.

The following interesting particulars of the great eruption which occurred on the 1st of January last, are derived from a letter, addressed by M. Leopold Pilla to M. Elie de Beaumont.

The eruption commenced on the 1st of January, at six o'clock in the morning. An immense column of black smoke was seen to issue from the mouth of the volcano, in fuliginous wreaths. It was of that colour which the smoke of Vesuvius almost always presents at the termination of an eruption; but was this time observed at the commencement. After a few minutes, a remarkable shower of small *lapelli*, or small stones, fell at Naples; they were of a greenish brown colour, the largest not bigger than a pea. They were hollow, like small bladders; and so thin, that the slightest touch would break them: and they floated upon water. While this shower was falling at Naples, (where a like phenomenon was never before seen) the wind was blowing from the north-east; which seems to indicate, that some other cause must have acted to convey them so far from the volcanic focus, in a direction contrary to that of the wind. This shower continued two or three minutes. Soon after, a stream of lava burst from the interior of the crater, on the side of the hermitage, and arrived, in half an hour, not only at the foot of the cone, but nearly a mile below—an enormous velocity for a stream of lava, and almost equal to that of water! In the course of the day, the volcanic phenomena abated.

On the morning of the 2nd of January, at the same hour as on the preceding day, the volcano burst forth again with increased violence. A cloud of smoke appeared, which, as it rose in the atmosphere, assumed the form of an immense plume of feathers, white and cottony, and bending towards the west. The hollow, muffled sound of distant detonations, was frequently heard. In a short time, two streams of lava flowed from the crater; one, on the side of Presina, and the other, on the side of Pompei: the former, larger, but less rapid, than that of the preceding day. The eruption continued, without abatement, the whole of the day; and, in the evening, presented a most magnificent spectacle. The summit of the mountain presented an immense mass of fire; one portion of which rolled down in the form of fiery ribbonds, and the other was projected upwards in the form of a shower of stones, or rather masses of burning rock; which fell, still burning, upon the sides of the mountain. According to the observations of M. Capocci, Director of the Observatory, the stones were thrown up as high as 1,100 feet above the crater of the volcano. The explosions continued almost without interruption, as if they were produced by a continual subterraneous blast. In the midst of the burning columns, were seen flashes of lightning, in various directions; most frequently striking upwards, but sometimes, horizontally, and sometimes, downwards.

In the mean time the great current which descended in the morning on the side of the hermitage, threw itself, in the evening, into the Fosso-Grande, where, till the present time, only two streams had entered from modern Vesuvius; that from the eruption of 1767, and that from the eruption of 1810. The most remarkable phenomenon observed, at this period of its progress, was the ammoniacal odour which exhaled with the smoke. M. Pilla remarks upon this circumstance, that the formation of ammoniacal salt upon several parts of the lava, after it had cooled, only took place in those parts where it had passed over cultivated land; hence he concludes that this salt is produced by the re-agency of the hydrochloric acid contained in the land, upon the animal matter which is employed for manure. The current stopped at the mouth of the Fosso-Grande. In the morning the eruption was greatly diminished; but the electrical corruscations were at their maximum in the middle of the column of smoke which rose from the volcano, and they were visible at mid-day; they might be compared to the fulminations which are observed in the clouds, near the point which is the centre of the tempest; they succeeded at intervals of from one to two minutes; they were not accompanied by any noise. The mass of smoke emitted in the morning, was carried by the north wind in the direction of *Castellamare;* it produced so dense a shower of lapelli, that all the plain, which extends from *Bosco tre Case* as far as Castellamare, was covered with the thickness of from four to six inches of stones. All the corn and vegetables were destroyed in this part of the country. The road of the Calabres, which passes by Torre dell' Annunziata, was so encumbered that communication was interrupted until the government ordered the stones to be removed. At Torre dell' Annunziata, and Bosco tre Case, the inhabitants were almost all occupied in delivering the tops of their houses and

their terraces from the weight of the lapelli which had lodged upon them; they were heaped up in the streets, in such great quantities, that it became impossible to walk through them. The sizes of these lapelli were variable; the greater number were the size of hemp seeds, but there were some as large as hazel nuts, some as large as a walnut, and some even as large as a hen's egg. They were formed of scoriated lava, which was not so hollow, nor so vitrified as the small lapelli which fell at Naples; the largest always contained crystals of pyroxine, and sometimes flakes of mica, of a dark brown. As these substances were never found in this state in the lapelli which fell near the crater, M. Pilla thinks that the different circumstances of their cooling, by falling from the atmosphere a great distance from the volcano, had contributed greatly to the crystallization of the pyroxenes and the micas which they contained.

After the 3rd the eruption gradually subsided, and on the 5th it had entirely ceased; its duration therefore was short; but its intensity was very great.

M. Pilla observes, that during the latter half of the year 1838, there was a very striking alteration of action between Vesuvius and Etna: Vesuvius was in eruption in the months of July and August; as soon as that eruption ceased, Etna commenced, and continued till December. On the 1st of January Vesuvius again resumed its terrific action.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, May 24, C. Johnson, Esq., on Botany. Friday, May 3, Robert Addams, on Chemistry, in conclusion. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, April 30, Dr. R. D. Thomson, on Digestion and the Digestive Organs. At a quarter to nine.

Poplar Instiiution, East India Road. Friday, day, April 30, Mr. Davis, on Physiology. Friday, May 3, Discussion on Temperance Societies.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, May 2, a Discussion on Temperance Societies. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, April 29, A Musical and Philosophical Variety. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday May 2, W. Ball, Esq., on the Comic Literature of the Kingdom. At half-past eight.

QUERIES.

To the Editor of the Mechanic and Chemist.

SIR, Can you or any of your numerous correspondents inform me how I can take impressions of flowers? What is the best work on short hand? In what books can I find examples of the different modes of disputation, particularly that of Socrates? W. P

SIR, Having made use of oiled paper to enclose paste blacking, I find that the vitriol absorbs the oil, and renders it useless; I shall, therefore, be much obliged if your or any of your correspondents would inform me of an easy method to prepare paper in imitation of bladder for the purpose above stated. J. M.

SIR, A "Constant Reader" begs to know if a specimen of Messrs. Barton's (of Bristol) velocipede is to be seen in London, and where; and also where a description and view of Mr. Ritchie's carriage, or machine may be obtained?
A CONSTANT READER.

SIR, I beg leave to ask if you, or any of your correspondents can inform me where I can procure some portrait prints, magazine size, of the following personages living in the reign of Charles I. and II. I have inquired of several houses, and cannot procure them:—Elizabeth, Countess of Northumberland and Duchess of Somerset; Barbara, Countess Southampton and Duchess of Cleveland; Louisa, Duchess of Portsmouth; Henrietta, Countess of Rochester; Elenor Gwyn, called Nelly Gwyn; Lady Gramont; Mrs. Nott; Mrs. Lawson; Lady Denham, and Lady Ossory.
W. W.

SIR, Will you or any of your numerous subscribers have the goodness to inform me through your inestimable journal, of a few rules for the art of modelling in card or pasteboard? Also a few examples of architectural modelling, something similar to those lately given on papyro plastics? C. J. C. R.

SIR, Can any of your intelligent correspondents inform me whether there can be made a solution to colour steel, that it may have a gold or silver appearance, similar to the appearance steel has when immersed in a solution of the sulphate of copper; without the medium is cheap, the expense will more than balance the effect required? W. J. N.

SIR, Can you or any of your numerous correspondents inform me of the names of the colourless fluids which are put on pictures which turn into a bright colour, sometimes blue, at other times green, &c., when warmed.
W. M. B——R.
Piccadilly, April 17.

ANSWERS TO QUERIES.

Chromates.—SIR, The following may, perhaps, be useful to your readers, and at the same time answer the query of "J. N. C."; it is extracted

from "Partington's Cyclopœdia of the Arts and Sciences." The alkaline chromates are soluble and crystallizable. They are of a yellow or red colour, the neutral chromates being commonly yellow, and the bi-chromates red or deep orange. The best known of these is the bi-chromate of potash, which is one of the most splendid, and, at the same time, one of the most useful salts. The manner in which it is formed is as follows:—Chromate of iron, or rather ferruginous oxide of chrome, reduced to fine powder, is mixed with half its weight of nitrate of potash, and heated strongly for an hour or two in crucibles. The resulting masses are then repeatedly digested with water and the coloured liquids, which are slightly alkaline, saturated with nitric acid, and concentrated by evaporation till no more crystals of nitre can be obtained from them. The yellow liquid being now set aside for a week or two, deposits a copious crop of crystals, whose form is that of a four-sided prism, terminated by octihedral summits. Their colour is an intense lemon yellow, with a slight shade of orange. 100 parts of water at 60° dissolves about 48 parts; but boiling water dissolves almost any quantity. Its solution in water decomposes most of the metallic salts; those of mercury of a fine red; copper and iron of a reddish brown; silver, dark red; and lead of a beautiful yellow colour, now much used as a pigment under the name of chrome yellow. Chrome yellow is largely manufactured in the United States, at Baltimore, near which place is found one of the most remarkable deposits of ferruginous oxide of chrome in the world. The process consists in adding a solution of acetate of lead (or sugar of lead) to the rough solution of chromate of potash, from which the nitrate of potash has been just separated by crystallization. The acetate of lead is added as long as any sediment falls. The liquid is then filtered, and the yellow precipitate left on the filters dried for sale. W. H. P.

Rahere-street.

Dissolving Views.—Sir, I beg to inform "W. E. F." that the way in which the views he speaks of are exhibited, is with two magic lanterns, by throwing the view of one on the other; thus, supposing the view to be the quadrant in one lantern, and a perspective grove in the other, one person holds the quadrant at its proper focus from the screen, and the other at a little distance behind him, so as to be out of the focus, then the grove advances while the quadrant retreats, until the quadrant gets out of the focus, and the grove into it, of course all this must be done gradually, and according to the judgment of the exhibitors, the views are painted on glass, and represented by phantasmagoria.

Another Method.—Sir, In answer to your correspondent "W. E. F.", I have the pleasure to inform him, that to exhibit the dissolving views, two phantasmagoria lanterns are required, and the views painted in pairs. The reflections from both lanterns are made to fall upon the same spot on the cloth. A pair of sliders are introduced, one in each lantern, one *in* focus, the other *not*. When the change is to be made, the view *in focus* is gradually to be brought *out of focus*, and that which is *out*, is to be brought *in*, either by shifting the tubes containing the lenses, or by increasing one light and diminishing the other. F. E. L.

Manifolds.—I also beg to inform "Reporter," that I have heard that manifolds are made by rubbing sweet oil and lamp-black carefully over the paper, but I think with him that it might be greatly improved. I thank "F. E. L." for the account he has given me of the quick match, which will answer my purpose very well.

J. R.

Varnish for general Use.—In answer to your correspondent "G. M. F.", I have the pleasure to send you a receipt which forms an excellent varnish for general use:—Take of colophony, one ounce, set it over the fire in a well-glazed pipkin till it is melted; then by little and little strew two ounces of powder of amber, stirring it all the time with a stick; then put in a little turpentine oil, which will thin and soften it; immediately put in two ounces of gum copal, finely powdered, sprinkling it in as you did the amber, occasionally pouring in a little oil of turpentine, after which pour it into a coarse linen bag, and press it between two hot boards of oak, or two pieces of flat iron. This forms a good varnish for wood, &c., and is particularly useful for guilt picture-frames. E. M. J—s.

TO CORRESPONDENTS.

W—m C. G. *We cannot answer him, unless he informs us to what instrument the expression refers; it was probably an aperture to admit a ray of light at some particular angle.*

An Amateur Chemist. *A correspondent* "W. C.", *politely offers to convey the desired information to* "An Amateur," *either through the medium of this work, or by post; if by post, he will be able to give a more minute description.*

P. W.'s *suggestion shall be attended to.*

W. P. *Flowers and small plants are preserved, by spreading them carefully out, and drying them between the leaves of a book. Small plants should, if possible, be obtained entire with the root and blossom. In many places, on the Alps and other mountains, persons are employed in collecting specimens of curious and rare plants, which they sell chiefly to visitors. A cheap Æolian harp may be made by merely extending a violin string supported by two bridges, between two deal boards about an inch apart.*

J. B.'s *communication suggesting an improvement in the construction of boats for shooting, shall be examined and probably inserted.*

F. E. L.'s *queries have been mislaid. If he will forward them to our office they shall be inserted.*

W. P.'s *question has been answered in a former number.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XX. NEW SERIES. | SATURDAY, MAY 4, 1839. (PRICE ONE PENNY.) | No. CXLI. OLD SERIES.

LANGSTAFF'S VELOCIPEDE.

Fig. 1.

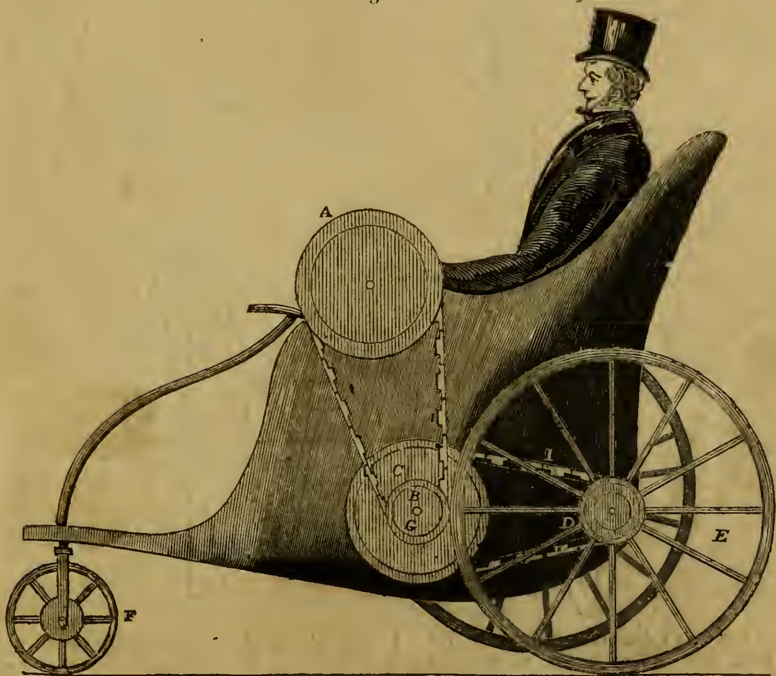


Fig. 4.

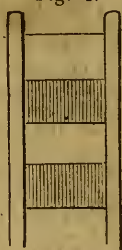
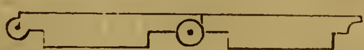


Fig. 3.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

LANGSTAFFE'S VELOCIPEDE.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Should you think the following description of a velocipede worthy of your notice, would you be kind enough to favour me, by inserting it in your useful publication?

A, fig. 1, is a wheel 12 inches in diameter, which is turned by the traveller, communicating, by means of a band, I, to another wheel, B, 6 inches in diameter, which is fixed firmly on the spindle, G, which forms its axis: in the centre of this spindle, is another wheel, C, 12 inches in diameter, communicating, by means of a band, to the wheel, D, 4 inches in diameter; on whose axis, are fixed the back wheels, E, E. The small wheel, F, is to guide the machine; being worked either by the feet, or one hand of the traveller: the other being used to turn the wheel, A.

Fig. 2 is a back view of the machinery; showing the positions of the wheels, E, E, A, B, C, D, &c.

Fig. 2.

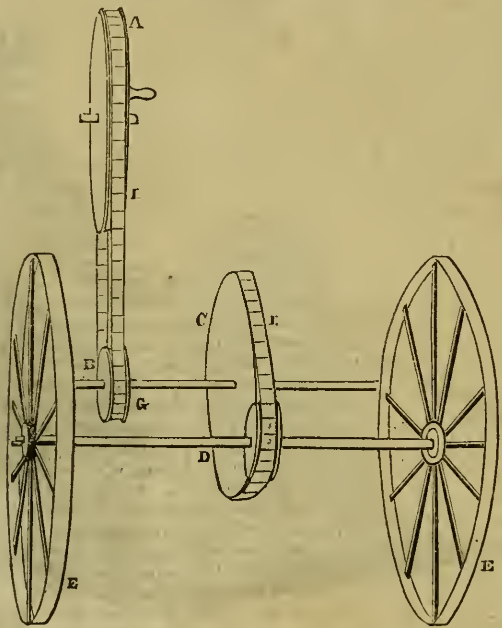


Fig. 3 is a drawing of the bands, I, I. I find, that where there is much force wanted, the common lathe bands, which are generally made of leather, gut, &c., are useless; for they work round the wheels without carrying the wheels round with them. To avoid which, I have a band made of pieces of iron, the joints of which are the same as those of a common door-hinge.

Fig. 4 shows the manner in which the chain, or band, is prevented from slipping off the wheels, by a projecting rim.

The above machine, I think, will answer exceedingly well for travelling; as a person might ascend the hills which are generally met with in country roads, with a very little exertion; and might regulate his speed in descending. From calculations I have made, the machine may be made to accomplish 12 or 14 miles an hour with the greatest ease.

Your's obediently,

J. Langstaffe.

British Museum.—On Easter Monday last, 20,359 persons visited the Museum. Although much too crowded to afford opportunity for a careful examination, to anyone, yet the habit of visiting the place on a holiday, will gradually form a taste for making a holiday to see it more at ease. The crowd, on Monday, were orderly and well-behaved; and, out of so great a number, only one instance occurred of any attempt at "handling."

STANDARD OF MEASURE.

To the Editor of the Mechanic and Chemist.

Sir,—In my letter upon the French metre last week, there are two errors of the press which need correction. The names Berout and Feyssédre, are put instead of Bezout and Teyssédre.

I quite agree with your remarks in regard to a standard of measure. If we must take some natural quantity as a base for linear measure, it should not be a degree of the meridian; for two reasons: it is difficult, as you observe, to measure it accurately; and, besides, no two degrees of a meridian can be of the same length. Were all nations to adopt one of their own degrees as a standard, their measures, so far from having a universal basis, would differ from each other according to the latitude. This difference, it may be said, is not very large; as the polar and equatorial diameters of the earth want only 26·478 miles of being equal: but there is no necessity to submit to the risk of errors, however small, when it can be avoided. If, on the contrary, every country would assume the pendulum of its capital, as a standard, the measures of all nations could be calculated with comparative ease and correctness. M. Coulier objects to this use of the pendulum, because the portion of time denominated a *second*, is an arbitrary distinction. This is true; but as most, if not all civilized nations use the same divisions of sidereal time, which, in astronomy, are interchangeable with space, and can therefore be pretty well fixed, I do not see the force of his objections. Theoretically, indeed, the sidereal year is not constant; as the earth moves through so great a distance in its annual revolutions: but this difference is quite inappreciable in practice.

I am, Sir,

Your's truly,

C—s C—r.

[If the great equatorial circumference of the earth could be accurately measured, an universal standard would be obtained; by reference to which, all measures might be computed, and their exact relative value ascertained: but if the pendulum were adopted as a standard, it could be much more readily referred to; as the relation between a given length, and a given period of time, is accurately known. With respect to fixing the value of a second, it must be observed, that all instruments employed to measure time, are submitted to correction, by being compared with the computed mean time; therefore, if there be any perceptible error in the observation, it must be attributed to the inaccuracy of the instrument, rather than to the astronomical calculation. There is no method at present known, of establishing a standard, absolutely unerring, even in theory. But the pendulum is a sufficient approximation for any practical purpose, provided the observation be made *in vacuo*; for, besides the perturbation, occasioned by the resistance of the air, the effective force of gravity varies with the density of the medium in which a pendulum vibrates: and the times of its vibrations, are, as the force of gravity directly, and the force of inertia inversely; and the latter force is invariable under all circumstances.—Ed.]

SOUTH AUSTRALIA.

*From Messrs. Im'ay and Hill's Account of an Excursion to the River Murray, in January, 1838.**

"On passing the high ground above the river, we discovered a large net made of cord as thick as garden line, with meshes well finished and large enough to entangle salmon, above which lay a wooden utensil in the shape of a small canoe, evidently hollowed out of a solid piece of timber. The proprietors had, no doubt, dropped these articles on first perceiving us, and secreted themselves among the reeds; for when we called our kangaroo dogs, which were foot-sore, and unwilling to move, we heard them imitating our voices. On ascending an eminence which commanded a view of the adjoining country, we perceived signal fires in every direction. The slight deviation from the reverse of the course steered on going to the river, took us through the pine forest, in a very short time, on to the clear bank of the rivulet already mentioned as receiving the water from the last tier of ranges; we now made rapid progress, soon ascended a sloping ridge, and proceeded several miles through an open country, interspersed with blocks of sandstone, similar in appearance to that we had passed through in the morning. The sun was now getting very low, and, as there was no sign of water in the hollows, we made for a high mountain about three miles off, rather to the left of us, which answered the description we had been given of Mount Barker; near which, we had been informed, there was plenty of water. We passed over a sandy, scrubby country to its base, without seeing the

* The month of January in Australia, corresponds with July in the Northern Hemisphere.

slightest sign of a rivulet On a sudden, we found ourselves at the top of a deep ravine, the bottom of which was, at least, one thousand five hundred feet below us; the true Mount Barker was seen five or six miles to the left, and the ranges of Mount Lofty, piled one above another, were towering before us. However much we might have been inclined to admire the scene at any other time, at present, we only looked upon it as a bar to the greatest luxury which a bushman has—viz., a pot of hot tea for supper, and plenty of food and water for his horse. There was no time to be lost; the only chance now left us, was, to find water at the bottom of the gulley: we therefore dismounted, and led our horses down with as much expedition as the nature of the ground would allow, and, as we had anticipated, discovered a small water-hole, about one-third full. It was now quite dark, and being near a fallen tree, and plenty of grass for the horses, we camped for the night. When tea was made, the water was so brackish, that a little extra sugar did not cover its defects. In a short time my companions, wrapt up in their blankets, with their heads on the saddles, and their feet towards the fire, were fast asleep. The grandeur of the surrounding scenery kept my eyes open for some time; the large, blazing fire displayed, to great advantage, the gigantic arms of the huge tree which overshadowed us. The sky was particularly clear, and the stars shone with unusual splendour before me: in the deep blue sky floated *Sirius*, *Aldibaran*, and other stars of the first magnitude. The beautiful constellation *Orion* had attained its meridian glory, and, emblematic of man, was gliding slowly towards obscurity, whilst another gradually rose to supply its former position. Behind me was the remarkable constellation of the *Southern Cross*; beneath which the resplendent *Centaurs* skimmed along the 'dark brow of the mountain;' on my left were the *Magellan* clouds, and the *Milky Way* with its myriad of worlds. The utter insignificance of myself and companions, compared with the objects around, filled my mind with awe and veneration for that Almighty Being who had created all. We slept soundly, and awoke at daylight with our blankets saturated with dew, which fell during the night. Nothing can afford greater proof of the salubrity of the Australian climate, than the fact of our sleeping on the ground, at all seasons of the year, without feeling bad effects from it. I have frequently awoke with my blanket drenched with rain, but never caught the slightest cold or felt the least indisposition from it; and I do not recollect having heard of any of my acquaintance suffering from exposure in this way. On the contrary, I have been told of persons labouring under rheumatic affections for years, being cured effectually by undertaking a long journey to their stock stations, where they were obliged to bush it for a few nights."

WOODEN PAVEMENT IN THE CITY.

On Wednesday, in the committee of sewers at Guildhall, it was determined to try the experiment of a wooden pavement in the carriage-way opposite to the Central Criminal Court. It is expected, that the wood will effectually prevent interruption in the court, from the noise of carts and carriages, as well as be incomparably cheaper. There are to be two patterns laid down: the one, the patent of Mr. Stead, whose wooden pavement, in Oxford-street, has been so highly commended; the other, the patent of Mr. Geary, who, a short time ago, petitioned the Court of Common Council on the subject, and offered, if his experiment did not satisfy the corporation, to remove it, and substitute the stone pavement, without making any charge. The contractors will commence operations in the streets in six weeks, and will complete the pavement in sixteen hours; so that there will be no interruption to the traffic through the street. It was stated, on the occasion of the meeting of the commissioners, that Colonel Wilson, the engineer to the Emperor of Russia, said, that the wooden pavement in Oxford-street was superior to that used in the capital of the Emperor's dominions. It is believed, that the wooden pavement will soon be laid down in the vicinity of the City churches; and two eminent engineers have received instructions, to inquire whether the wooden pavement is likely to answer on inclined planes as well as on levels. From this fact, we calculate, that it may be the intention of Mr. Prior, the chairman of Blackfriars-bridge, who is anxious to make the improvements in that edifice, as great as possible, to lay down a pavement of the most approved kind. The patentees of the two patterns of wooden pavements stated, that the cleanliness of the new plans would strike the public as remarkable; and Mr. Stead declared, that the dirt which appeared upon his portion of pavement in Oxford street, was occasioned

by the accumulation from the neighbouring stone pavement which had been laid down in competition.

COMMON ROAD LOCOMOTION.

To the Editor of the Mechanic and Chemist.

Sir,—Some time has unavoidably elapsed since I promised to lay before your readers (and "C. H. S." in particular) more facts respecting the effects of Railroads, and the benefits of common road locomotion. But, to begin, all I can gather from "C. H. S's" Letter is, that he wishes to inform me that more people are employed by the Railway, than there were before by the various stage coaches; and, as his arguments are all founded on suppositious evidence, I will not attempt to refute them by the same methods, but let facts speak for themselves.

In the town of St. Albans, in the year 1830, rents were high, trade was brisk, and there was scarcely an empty house in the town; indeed, such was pretty much the case with all the places on the Holyhead route. But since July 1837, the tables have been quite turned, and Hockliffe, Dunstable, Markayte' Street, Redbourn, St. Alban's and Colney, present quite a desolate appearance. The village of Redbourn, independent of the parish, has a population of 750 persons, 200 of whom depended on horse keeping, and the intermediate traffic occasioned by posting, &c. for their support. Whereas 20 men would be quite sufficient to perform all the duties of attendance required there by the animals now working the road. The Railway has stopped a circulation of 50*l.* per day in the above place (no trifling sum in a country village,) though I am very sure it has not been transferred to the neighbouring districts of Watford, Boxmoor, Berkshamstead, &c. The Railway has, I have no doubt, been thought greatly to benefit Watford, owing to its proximity to it, but I can assure your readers to the contrary, on the testimony of several old and enterprising inhabitants of the place.

Aylesbury and Berkhamstead have also suffered greatly; the George, at the former, and the King's Arms Inn, at the latter place, finding their business not a little slackened by it.

St. Albans may be considered as a ruined place, containing 250 houses destitute of inhabitants, a large number of stables, and some 300 persons out of employ. The "Verulam Arms" posting house, which formerly found work for 36 horses, can scarcely employ a dozen now, and is, in common with most of those large inns, almost destitute of company.

This is not the work of magic, or necromancy, but merely the effect of the Birmingham Railway; and should "C. H. S." think that these facts are not a sufficient plea for my having called the attention of the public to them, I beg to say, that I shall be most happy to inform him more fully than I can now, without trespassing on the pages of your useful work.

I remain yours, &c.

T. Samuel Browne.

St. Albans, April 18, 1839.

WONDERFUL SHIP.

To the Editor of the Mechanic and Chemist.

Sir,—I beg leave to place before you the particulars of a vessel which was built by Messrs. Ditchburn and Mare (iron steamboat builders) at their yard, at Deptford, and launched on the 15th instant. I think this surpasses anything I ever read of in the annals of naval architecture. She is a most splendid vessel of 700 tons, her length from stem to stern 190 feet, and drew at launching only *eighteen inches water!* Her engines, two of forty-horse power, are making by Messrs. Miller and Ravenhill, Blackwall. She is destined for the Rhine. I remain yours, &c.

Spectator.

Singular Illusion.—Affix to a dark wall a round piece of paper, an inch or two in diameter; and a little lower, at the distance of two feet on each side, make two marks; then place yourself directly opposite to the paper, and hold the end of your finger before your face in such a manner, that when the right eye is open, it shall conceal the mark on the left, and, when the left eye is open, the right; if you then look with both eyes to the end of your finger, the paper, which is not at all concealed by it from either of your eyes, will, nevertheless, disappear. W. M. B—r.

The Glowworm.—The glowworm possesses the curious property of causing its light to cease at will. Dr. Burmeister mentions the curious fact, that while catching some of the flying species in his hat, they have so suddenly and entirely ceased to shine, that he has fancied that they must have escaped. When disturbed, these insects emit a bright, but frequently interrupted light; and, when laid upon their backs, they shine without intermission, in consequence of the continual motion in the endeavours of the insect to regain its position.

THE CHEMIST.

OXIDES OF ANTIMONY.

Antimony was first made known as a metal in the 15th century by Basil Valentine. It is said to derive its name (antimoine, anti-monk) from its having been fatal to some monks, to whom it was given as medicine. Its only abundant ore is the sulphuret, from which the metal is obtained, by mixing it with half its weight of iron filings, and exposing it in a covered crucible to a red heat, or by mixing it with two-thirds of its weight of cream of tartar, and one-third of nitre, and throwing it in small portions into a red hot crucible. By the first process, the sulphur combines with the iron, forming sulphuret of iron, while the metallic antimony collects at the bottom of the crucible. In the second it is expelled in the form of sulphurous acid, and the metal collects at the bottom as before: but to obtain the metal pure for chemical purposes, you must heat the oxide with an equal weight of cream of tartar.

It is a brittle metal, of a white colour, running into bluish grey, with a high metallic lustre. Its specific gravity is nearly 6.7; it fuses at 810° Fahrenheit; it is volatile at a very intense heat. When heated to a full red heat with a covered crucible, and then suddenly exposed to the air, it inflames and burns to a white light. This must be conducted with caution, as the fumes of this metal are very injurious. The sesoperoxide of antimony may be prepared by adding carbonate of potass, or soda, to a solution of tartar emetic; or by condensing the vapour which rises during the combustion of the metal. It is a white powder of rather a dirty appearance. When heated, it changes to a yellow tint; at a red heat in close vessels, it is fused into a yellow fluid, which becomes an opaque greyish crystalline mass on cooling. Its specific gravity is 5.566. It is very volatile, and is the only oxide of antimony which forms salts with acids; it is the base of the tartar emetic, which is a tartrate of antimony and potash. Most of its salts are insoluble in water; or, like chloride of antimony, are decomposed by it, owing to water having a greater affinity for the acid, than the acid has for the oxide. This oxide is, therefore, but a very feeble base. The tartrate of antimony and potash is, however, an exception, for it dissolves in water without change.

Antimonious acid is another oxide of antimony; it may be prepared by digesting the metal in strong nitric acid; the metal is oxidized at the expense of the acid, and the hydrated antimonic acid falls; then expose this substance to a red heat; it gives out water and oxygen gas, and is converted into antimonious acid. It is white while cold, but turns to a yellow tint when heated.

Antimonic acid, or peroxide of antimony, is made as a white hydriodate, by digesting the metal in strong nitric acid, and then drying the precipitate with alkalies, it forms salts which are called antimoniates. When this oxide is exposed to a temperature of 600° Fah., the water is evolved, and the anhydrous acid of a yellow colour remains; in this state it resists the action of acids.

A. Taylor.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, May 8, H. Brown, Esq., on the Writings and Genius of Sterne. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, May 7, Dr. R. D. Thomson, on the Diseases and Management of the Digestive Organs. At a quarter to nine.

Poplar Institution, East India Road. Tuesday, May 7, Dr. De Normandy, on Geology. Friday, May 10, Discussion.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, May 9, M. C. Gascoigne, Esq., on Switzerland. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, May 6, Mr. Morton, on Mechanics. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, May 9, W. Ball, Esq., on the Comic Literature of the Kingdom. At half-past eight.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir, I have it in contemplation (being a sportsman) to build a caravan, or omnibus, such as the gypsies use, for the purpose of travelling through the country in the shooting season; and as I am ignorant of the best mode of effecting this in the way of economy and usefulness combined, would you or any of your correspondents be so kind as to give the address of a good workman who would be content with moderate profits?

T. P.

Sir, I shall feel particularly obliged if you or any of your correspondents will inform me, how to prevent ink from freezing and getting mouldy. J. J.

Sir, Can any of your intelligent correspon-

dents inform me of the best method of taking out ink-stains from carpets? W. W.

Sir, I have seen in one of the Almanacks an account of a company for making bricks by pressure, instead of burning; it is stated the bricks are pressed as hard as stone. I have also seen an account of pressing earth into blocks for building garden walls. Can you or any of your numerous correspondents be so kind as to favour me with a sketch of the plan they have for pressing, with a description of the same; and also state the power and speed of the machine, with the expense of erecting one? You will also oblige by stating what is considered the best treatise on iron and iron works; i.e., plain and simple directions for erecting the furnaces, the management of the iron ores, the quantity and quality of fuel and lime to be mixed for smelting, &c.? Also, the best plan now in use for making and burning bricks, with a description of the clay that is best for making what is called fire bricks? Please to say how pyrolignous acid is sold? A Subscriber.

Tavistock, April 27, 1839.

Sir, I was much pleased with the plan of the portable vapour bath in No. 18, and hope some of your correspondents will send two or three plans of other baths for private use (cheap and portable), by so doing they will much oblige,

Blackfriars-road. J. Adams.

ANSWERS TO QUERIES.

How to make a Silver Tree. Sir, In answer to " P. Truman," I beg to state the following:—Put into a decanter four drachms of nitrate of silver, and fill up the decanter with distilled or rain water; then drop in about an ounce of mercury, and place the vessel where it may not be disturbed; in a short time the silver will be precipitated in the most beautiful arborescent form, resembling real vegetation. The above experiment shows the precipitation of one metal by another, owing to the affinity that exists between them; the metal in solution having a greater affinity for the pure metal suspended in it, precipitates itself from the solution, and becomes firmly attached thereto. The silver tree, produced as above described, is frequently called *Arbor Dianæ*, or the tree of Diana.

W—m B—r.

Sir, In accordance with the request of " F. E. L." (No. 18, New Series), I send the following receipts for coloured fires, hoping they will be of service to many of your readers:—

Red Fire.—Take of dry nitrate of strontia, 40 parts; finely powdered sulphur, 13 parts; chlorate of potash, 5 parts; sulphuret of antimony, 4 parts. Powder the two latter separately in a mortar, and then mix them upon paper; after which, add them to the other ingredients, previously powdered and mixed; no other kind of mixture than rubbing together on paper is required. Sometimes a little realgar is added to the sulphuret of antimony, and frequently a very small quantity of lamp-black will improve the fire if it burns dimly.—*Ure's Chemical Dic.* Great caution is requisite in pounding the chlorate of potash, as with a hard blow it is liable to detonate; and as the principal part it plays in the above composition is to supply oxygen to the combustion, I presume six or seven parts of nitrate of potass (saltpetre would be found almost as effectual) would make the article much cheaper and easier to manufacture.

Blue Fire.—Mix well together 600 grains of nitrate of potass, 200 of sulphur, and 100 of sulphuret of antimony. This mixture makes a glorious light, which is seen at a great distance.

White Fire.—This composition, which casts an extremely vivid white light when fired, is thus prepared:—24 lbs. of finely powdered nitrate of potass; 2 lbs. of red arsenic, and 7 lbs. of flour of sulphur; this well mixed, is put into boxes of thin wood, or stout cartridge cases, the head of which has a hole in the middle, covered over with paper, which is taken away when it is desired to set fire to it. A round case of six inches in diameter and three in height, will burn about three minutes.

To Extract Carbon from Carburetted Hydrogen. " F. E. L." is informed, that carburetted hydrogen may be sufficiently freed from its carbon, by passing it through a solution of lime or caustic alkali. I have frequently inflated small balloons on this plan, and I understand Mr. Green intends applying it to the great Nassau balloon the ensuing season.

" F. E. L." The decomposition of steam is certainly an economical method of obtaining hydrogen, to those who possess the requisite apparatus (a furnace, pneumatic trough, &c.); but when wanted by a tyro, and zinc can be bought for 3*d.* per pound, sulphuric acid for $1\frac{1}{2}$*d.*, a beer or wine bottle can be found in every house, and the tubing can be got at a gas fitter's for 2*d.* or 3*d.*, I certainly think the usual method to be the best.

How to Prepare Nitrate of Strontia. Dissolve the native earth in diluted nitric acid; the solution, when saturated, must be filtered and gently evaporated, when the salt will crystallize. Nitrate of barytes is prepared in a similar manner.

Preparation of Turkey Crops. " R. S. L." First take the crop and free it from the thick coat of fat which envelopes it; then turn the inside out, and wash the food out; soak it in water for a day or two, then lay it on a cloth, and with a bone or wood knife, scrape off the internal coat of the stomach, wash it well, and dry it with a clean cloth; then turn the crop, and begin the outside by first making an incision through the external coats, taking particular care not to cut through the membrane; draw the coats at once over the neck, which must be cut long for greater convenience in using the balloon when finished. Proceed with the other neck in the same way; tie it firm with silk, and cut it close to the body of the balloon; it must then be distended with wind, and hung up to dry. They may then be painted and varnished, but will not require it if properly prepared. They may be made large enough to contain a gallon of gas, and so light as to weigh only 30 grains.

Erasmus.

Sir, Having seen in No. 18 (New Series) of

your Magazine, a query by "R. S. L." wanting to know how to prepare phosphorus, nitrate of strontia, nitrate of barytes, and chloride of lime, I beg leave to send the following answers:

How to make Phosphorus. Phosphorus is obtained from impure superphosphate of lime, procured by acting upon powdered bone earth by sulphuric acid diluted with water; these are to be simmered together for about six hours, then strained; the liquor is then to be evaporated to half its bulk, and left to cool; a sediment will be formed, and the clear solution must then be evaporated to dryness in a glass vessel; this must be fused in a platinum crucible, and poured into a clean copper dish. This substance will yield phosphorus when distilled at a bright red heat with charcoal. N.B. There are other methods of obtaining this substance, but I think this the most economical.

Nitrate of Strontia is obtained by immersing the native carbonate of strontia in nitric acid, and evaporating the solution to dryness.

Nitrate of Barytes is obtained by immersing native carbonate of baryta in nitric acid, and evaporating it as in the former.

Chloride of Lime is obtained by allowing chlorine gas to pass into a vessel having shelves, upon which is placed a quantity of slacked lime. The process is allowed to go on for about three days, when it is found that the lime has imbibed a sufficient quantity of the gas. C. C.

To Stain the Hair.—Sir, In reply to your correspondent "P. Truman," I beg to state, that a solution of muriate of gold diluted with water, stains the hair of a brown or auburn colour, and this colour is as permanent as the hair.

P. T.

To Prevent Book-worm.—Sir, I have sent you the following on preventing the ravages of the book-worm; I beg leave to suggest that corrosive sublimate is the certain destruction of every kind of insect; if, therefore, it was mixed with the pulp of which paper is composed, and the bookbinders with the paste and glue which are used in book-binding, the future works of our modern authors would have this chance of becoming immortal; moreover, if a small quantity of corrosive sublimate (two table spoonsful) dissolved in one quart of proof spirit, were applied by means of a camel's hair pencil to the covered ways and mines, further injury would be prevented. Lastly, all winged insects have an aversion to the odour of turpentine; if, therefore, sponges dipped in the essence of turpentine, were suspended behind the bookseller's libraries, they would in all probability be secure from all depredation. G. Nash.

TO CORRESPONDENTS.

G. Nash *asks the following questions:—"1st. How could I construct a good achromatic camera obscura for the Daguerrotype? 2nd. What is the reason that if a spectator places himself at the bottom of a deep pit or well, that the stars in the firmament are seen in the day time? 3rd. What is the reason of the instrument called De Luc's Column losing its activity in the course of a month or two, as stated in No.* 101*? 4th. Is the precise spot known where Paradise was situated?"*

1. *When M. Daguerre divulges the secrets of his processes, we shall be able to present them to our readers without delay; at present, we can only admire the approximation of other philosophers, which we have good authority for asserting, must ultimately be eclipsed by the transcendent discoveries of that distinguished artist M. Daguerre.*

2. *The cause of the stars not being visible in the day time under ordinary circumstances, is the presence of the incomparably greater light reflected and refracted from the solar rays. A spectator at the bottom of a well being excluded from the action of the more intense light, can see the stars, the impediment being removed.*

3. *The instrument called De Luc's Column, is a dry galvanic pile; like all other similar arrangements, it is subject to lose its activity; but they have been known to retain it for years.*

4. In brachiis Evæ.

We offer these answers, accurate as far as they extend, inviting such of our scientific readers as have directed their attention to these subjects, to throw further light upon them—except Q. 4. which we have purposely taken in a more limited sense than our correspondent evidently intended, considering it an unfit subject for discussion in this work. With respect to his suggestion for preserving books from the worms, we can only say, that it displays great want of reflection; paper used for printing, is to be impregnated with deadly poison (corrosive sublimate), not merely laid on to the surface when required, but mixed up with the paste in the manufacture of the paper. If our correspondent considers the many unforeseen purposes to which paper, especially printing paper, is applied, being frequently sold to butchers and others who use it as an envelope for human food, he will doubtless consent to "withdraw his motion."

A Constant Reader.—*Any of the aromatic essential oils will combine with turpentine; but the odour of the latter is too powerful to be disguised by them. The odour is inseparable from the oil, and may be said to be identical with it. His drawing and description of a machine shall be examined.*

L. L. *Beer is heavier than water; porter contains a small quantity of spirit, which is lighter than water, but it also contains various substances in solution, which make the aggregate liquid about as heavy as sea water, that is about* 28-1000*th heavier than pure spring water. The specific gravity of wine is less than that of water, in proportion to the quantity of spirit which it contains. Hydrogen gas is the lightest, and pure platina is the heaviest substance known.*

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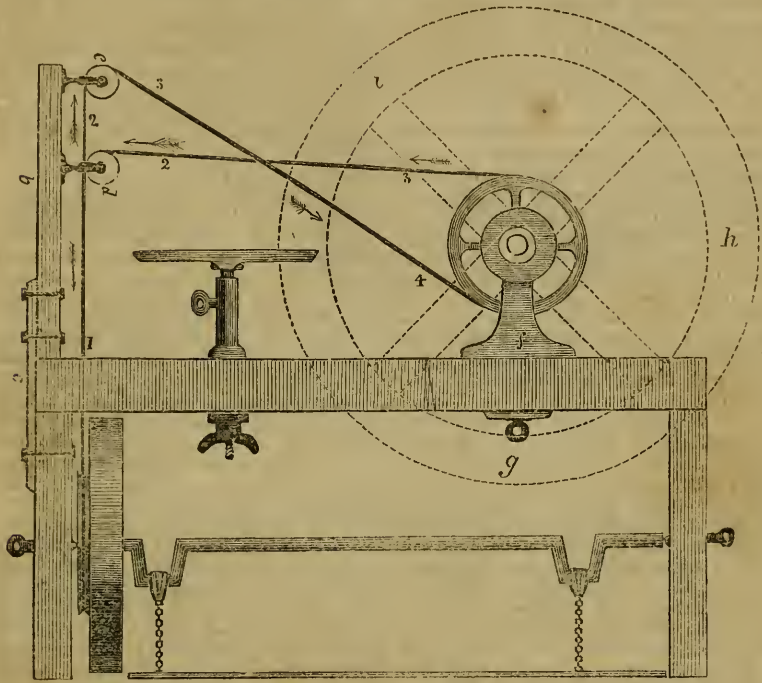
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

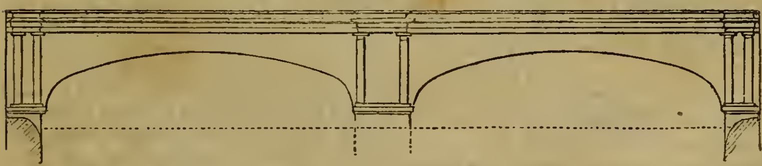
Nos. XXI. & XXII. NEW SERIES. | SATURDAY, MAY 11, 1839. (PRICE TWO PENCE.) | Nos. CXLII. & CXLIII. OLD SERIES.

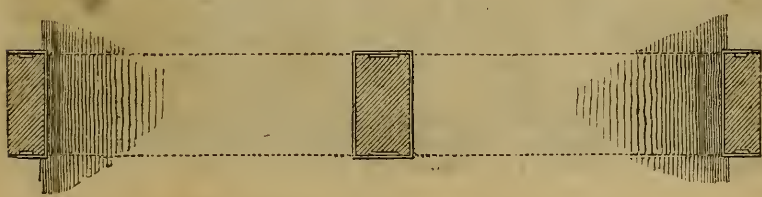
IMPROVEMENT ON THE FOOT LATHE.



IMMENSE BRICK BRIDGE OVER THE THAMES AT MAIDENHEAD.

ELEVATION.





PLAN.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

THE GREAT WESTERN RAILWAY.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—This railway, the construction of which has perhaps attracted more public interest than any other, has, for some time, been opened to Maidenhead. It will, before long, be opened to Twyford; and the works are in great progress at Reading. A short time since, I had occasion to travel on this line, and that too, by the latest train, (8 o'clock) when quite dark. By night, it is a spectacle at once grand and terrific. The sudden gleams of light from the furnace, their reflection flitting on the embankments, the clouds of illumined vapour flying swiftly past, the rumbling noise, and the lightning speed, render the effect most truly imposing. Having occasion to stop in Maidenhead for a short time, I inspected the adjoining parts of the line; and was particularly struck with the beauty of the bridge over the Thames, for the railway: of which the enclosed is a drawing; and a description of it, will, I trust, be interesting to your readers.

This bridge crosses the river on two wet arches only, and eight dry; whereas the *old* Maidenhead bridge crosses it on seven wet, and six dry arches. The arches are built entirely of brick; and are asserted to be the largest of the sort in Europe. The span of each wet arch is $128\frac{1}{2}$ feet, and the height in the clear from the springing to the crown, is but $24\frac{1}{2}$ feet. Each arch is struck from three or more centres. It was, some time ago, reported, that this bridge had given way. One of the arches it is true, did give way, and has since been pulled down, and re-erected. The bridge is quite completed, though the centering is not at present struck.

The top drawing is an elevation of the bridge, showing the banks in section; and the lower is a plan of the piers.

PROPORTIO.

THE ADVANTAGES OF HIGH WHEELS.

To the Editor of the Mechanic and Chemist.

SIR,—In confirmation of the opinion which you expressed in a recent number, respecting the advantages obtained by high wheels applied to carriages on rough roads, I beg leave to present your readers with a description of experiments whose results, though in no respect different from those obtained by calculation, will nevertheless be more satisfactory to such of your readers as do not wish to enter deeply into geometry. I entirely agree with you that no other advantage is derived from large wheels, except those which you have pointed out. The carriage which you lately described, and properly designated "monstrous," is extremely absurd in principle, and as it passes through the streets, seems to proclaim the misfortunes and disappointment which await those who, mistaking whims for opinions, and distortion for improvement, expend their money, time, and reputation, not only to discover themselves, but to display to the world that they are unacquainted with the simplest rudiments of the art which they pretend to improve. The following is from the *Phil. Trans.*

It having been asserted by *Mercennus*, *Herigon*, and *Dr. Wallis*, that the larger the wheels of a coach, &c. are, all other things remaining the same, the more easily they may be drawn over a stone or other obstacle; a model of a part of a waggon was made, consisting of four wheels, two axes, and a board nailed upon them; the lesser wheels were $4\frac{1}{3}$ inches high, and the greater $5\frac{7}{8}$; viz., one-twelfth of the ordinary height of the wheels of a waggon; and the weight of the model was almost $1\frac{1}{2}$ pound; there were also two other wheels $5\frac{7}{8}$ inches high, to be put on instead of the lesser; the middle of the two axes were $6\frac{1}{4}$ inches asunder: all the wheels turned very easily upon their axes. A piece of lead of $53\frac{3}{4}$ pounds was laid upon the model so forward, that the lesser wheels seemed to bear above two-fifths of the weight; then the model was drawn with a string laid over a pulley, whose top was one-fourth of an inch higher than the top of the hinder axis, and the middle of this pulley was $7\frac{1}{2}$ inches from the middle of the fore axis; the lesser wheels being put on, and the string tied to the top of their axis; 1. Three pounds drew the model on a smooth level table; 2. Twenty pounds drew the lesser wheels over a square rod one-fourth of an inch thick; 3. Thirty pounds drew them over a round rod a little more than one-half of an inch thick; 4. Thirty-one pounds drew them over a square rod half an inch thick; 5. Twelve pounds drew the hinder wheels over the bigger square rod, the string being laid under the axis five-eighths of an inch lower than before; 6. Twenty-nine pounds drew the lesser wheels over the bigger square rod; then the two bigger wheels being put on instead of the lesser, and the string lying over the axis; 7. Three pounds drew the model on the table; 8. Twenty-five pounds drew the fore-

wheels over the round rod; 9. Twenty-five pounds drew them over the bigger square rod; 10. The string lying under the axis, sixteen pounds drew them over the least rod; 11. Twenty-three pounds drew them over the bigger square rod; 12. Twenty three pounds drew them over the bigger square rod; 13. Thirteen pounds drew the hinder wheels over the bigger square rod.

In all these experiments, the lead was laid exactly on the same part of the board; but yet when the lesser wheels were taken off, the lead did not lean so much forward, so that the hinder wheels were somewhat more pressed than they were before. By comparing the second, third, and fourth experiments with the tenth, eleventh, and twelfth, it appears how much more easily a waggon, &c., might be drawn on rough ways, if the fore-wheels were as high as the hinder wheels, and if the thills were fixed under the axis; such a waggon as this would also be drawn more easily were the wheels cut in clay, sand, or any soft ground; besides, high wheels could not cut so deep as low ones. It is true, low wheels are better for turning in a narrow compass than high ones; but it seems probable that waggons with four high wheels might be so contrived, that there would be no great inconvenience in that respect; at least such waggons as seldom have occasion to turn short, as carriers' waggons and the like. The difference observable in the eighth and eleventh experiments, is agreeable to what is said by Stevinus and Dr. Wallis; viz., that if a carriage must be drawn over rough, uneven places, it is best to fix the traces to the coach, lower than the height of the horses' shoulders. 14. A table two feet and a half long was set with one end eight inches and a half higher than the other end, and the model being loaded as before, less weight by six ounces drew it up the table, when the bigger wheels were on, than when two bigger and two lesser were on; because in the first case, there was almost the same direction of the motion of the model and of the string that drew it; but not so in the second case, wherein the fore axis was so much lower than the top of the pulley. Q. E. D.

[We have since received the following communication on the same subject, and insert it, chiefly because we desire to promote a spirit of useful inquiry, especially on a subject of so great importance as the present question, and considering that actual experiment is preferable to speculative theory, unless accurate and sufficient data be obtained, and the investigation be conducted by a calculator of the highest order. We must, however, remark, that the experiments of our correspondent apply rather to different cases of friction, than to any circumstances of mechanical advantage; for in theory, that is, considering the effect to take place without impediment from friction, the least possible force would be adequate to put any weight in motion on a horizontal plane; and the effect of that force would be estimated by the *velocity* with which the weight would be moved; a circumstance which our correspondent has neglected to record.—Ed.]

To the Editor of the Mechanic and Chemist.

Sir,—It is the practice to make the hind wheels of waggons, and most four-wheeled carriages, the highest; but the advantage of so doing is not clear to me, and, from the following experiments, it seems to be erroneous:—Most people, too, concerned in the loading of waggons, have an idea that they are drawn more easily if loaded heaviest before, that is, on the fore-wheels. Having long since embraced a different opinion, I resolved to put it to the test of experiment. I made a small model of a waggon, in size a twenty-fourth part of the size of those used by farmers in general in the midland counties, and weighing ten ounces. This I placed on an horizontal board three feet long, which had a small pulley at one end, over which was passed a thin card, one end of which was fastened to the fore-part of the waggon, while from the other end there was suspended a small scale to contain weights; the scale by its own weight would just move the waggon along the board when unloaded.

The first trial was with four wheels of two inches, and hind ones of three inches diameter. The fore part of the carriage was then loaded with 32 ounces, and the hind wheels with 16 ounces. To move this along the board took five ounces in the scale. When the loading was reversed, that is, 16 ounces before, and 32 ounces behind, it was drawn by four ounces. It was next loaded with 32 ounces each pair of wheels, and was then drawn by six ounces.

The fore wheels were next placed in two hollows sunk in the boards three-eighths of an inch deep, loaded as in the first trial. The carriage was drawn out by 29 ounces, when loaded the reversed way, as in the second case, it was drawn by 21 ounces; when loaded equally by 33 ounces. The hind wheels were then taken off, and their places supplied by a

pair of equal diameter with the fore ones, namely two inches.

Loaded as in the first, second, and third instances, it took to move it along the level nearly the same weights; but when the fore wheels were placed in the hollows, it took less by four ounces each trial; when the loading was reversed and made equal, the results were as before. The pulley end of the board was then elevated to an angle of $33\frac{1}{2}$ degrees with the horizon, which is nearly equal to that of a hill rising four inches in the yard; if loaded as in the first instances, the carriage required to draw it up 18 ounces; loading reversed as before, 15 ounces; equal, 14 ounces; wheels in the hollows, nearly as before.

To the above may be added the very great uneasiness occasioned to the shaft-horse, when either of the fore wheels meet with any obstruction from stones, &c., and which is evidently increased in proportion to the smallness of the circumference.

I remain yours, &c.

W. M. B—R.

Piccadilly, May 6, 1839.

RAILWAYS.—A CURIOUS FACT.

To the Editor of the Mechanic and Chemist.

SIR,—As I was lately travelling, and with great pleasure, on the Southampton Railway, a singular circumstance in the history of railways, and which is very little known, forcibly occurred to my recollection. As it may in some degree interest most of your readers, I will venture to ask you to insert an account of it.

About twenty-three or twenty-four years since, Mr. Joseph Smith, of Coseley, Staffordshire, an excellent relative of mine, was deeply convinced of the extensive benefits which would result to commerce by a union of the principal towns and cities of the kingdom by railways. He used often to say among his friends, that he was sure, notwithstanding the greatness of the expense, that the work would one day be effected. He was so much impressed with the importance of the plan, and with its practicability, that he drew out a scheme, which is very similar to the one adopted in the present day; and it was inserted in the *Liverpool Mercury* about that period.

It was his intention to have followed that paper with some others, containing additional remarks and calculations; but the public mind was not, at that time, prepared to do justice to the subject, nor indeed even calmly to consider it.

In the next, or a subsequent *Mercury*, a correspondent inserted a paper, in which he ridiculed the whole affair; intimating, that he had long since devised a scheme for making a road to the moon; showing, I need not add, in a tone of sarcasm and irony, its practicability and manifold advantages; and gravely affirming, that he was encouraged and determined to bring forward his plan without delay, from the publication of the proposed undertaking of Mr. Smith, for superseding, in a great measure, the common turnpike-roads of the kingdom by iron railways.

Now, Sir, this great work, which then appeared so impossible and quixotic, has been actually done, or is in a direct course of accomplishment; and we do daily travel at the rate of twenty-four or twenty-five miles an hour on these iron roads, which appeared a short time since, to be so impracticable.

How evidently do wisdom and experience combine to inculcate the important lesson, that though a plan may appear singular, and sometimes even ridiculous, we should pause, and think, and diligently examine a proposal, or an object, before we rashly pronounce them to be of no value.

I am, Sir, yours respectfully,

B. H. D.

Southampton.

SALTNESS OF THE OCEAN.

THAT the present age is more remarkable for scientific discoveries and general improvement than any preceding period, will be readily admitted by all who are placed high enough in the regions of knowledge, to contemplate the great events which are passing around them; but we must not be so dazzled by the glories of the present, as to overlook or neglect the "light of other days." Hiero suggested the steam-engine, and Cicero the art of printing; Le Roi proposed the thermometrical balance for chronometers, and the inventor of the bottle-jack led the way to the best-known construction of a pocket watch; and yet little was thought of these things, till deeper thought, and more judicious application, developed the capabilities of their principles, and established their claim to the admiration of all succeeding ages. It is fortunate for us that our forefathers have had the care to preserve for us the most important discoveries and speculations of their days; that great recepticle of knowledge, the "Phi-

losophical Transactions," contains the germs of many subsequent inventions; and many suggestions of the present day heedlessly passed over, or condemned as absurd, may prove the foundation of the triumph of future philosophers.

The following curious remarks upon the saltness of the sea, and of several lakes, are condensed from a memoir of the great Dr. Halley:—The Dr. proposed an expedient for determining the age of the world by a medium, as he took it, entirely new, and which in his opinion, seemed to promise success, though the event cannot be judged of till after a long period of time; what suggested this notion to the Doctor was an observation he made, that all the lakes in the world, properly so called, are found to be salt, some more, some less, than the main ocean, which in the present case may be esteemed a lake, since by the term, the Doctor means such standing waters as perpetually receive rivers running into them, and have no exit or evacuation. The number of these lakes in the known parts of the world, is exceedingly small, and, indeed, upon inquiry, the Doctor could not determine whether there are in all any more than four or five; viz. 1. The Caspian Sea; 2. The *Mare Mortuum*, or *Lacus Asphaltites*; 3. The lake on which stands the city of Mexico; and, 4. The lake of Titicata, in Peru; which, by a channel of about fifty leagues, communicates with a fifth and smaller, called the lake of Paria, neither of which have any other exit. Of these the Caspian, which is by much the largest, is reported to be somewhat less salt than the ocean; the *Lacus Asphaltites* is so exceedingly salt, that its waters seem fully saturated, or scarcely capable of dissolving any more; whence its banks are incrustrated with great quantities of dry salt, of a somewhat more pungent nature than the sea salt, as having a taste of sal ammoniac, as the Doctor was informed by a curious gentleman who was at the place. The lake of Mexico, properly speaking, is two lakes, divided by the causeways that lead to the city, which is built in islands in the middle of the lake, undoubtedly for its security; after the model, it is probable, its first founders borrowed from beavers, who built their houses, or dams they make in the rivers, after that manner. Now that part of the lake which is to the northward of the town and causeways, receives a river of a considerable magnitude, which being somewhat higher than the other, discharges itself with a small fall into the southern part, which is lower; of these the lower is found to be salt, but to what degree the Doctor could not learn, though the upper be almost fresh, and the lake of Titicaca, being near eighty leagues in circumference, and receiving several considerable fresh rivers, has its waters, according to the accounts of Herrera and Acosta, so brackish, as not to be potable, though not quite so salt as that of the ocean; and they affirm the same of that of Paria, into which the lake of Titicaca does in part discharge itself, and which the Doctor doubted not would, upon inquiry, be found much salter than the other.

Now the Doctor conceived, that as all these lakes receive rivers, and have no exit or discharge, so it will be necessary that their waters rise and cover the land, till such time as their surfaces are sufficiently extended to evaporate the water which is poured in by the rivers, and consequently, that lakes must be larger or smaller, according to the quantity of fresh water they receive; but the water thus exhaled is perfectly fresh, so that the saline particles that are brought in by the rivers remain behind, while the fresh evaporate; and hence it is evident that the salt in the lakes will be continually augmented, and the water grow salter and salter; but in lakes that have an exit, as the lake of Genesaret, otherwise called that of Tiberias, and the upper lake of Mexico, and indeed in most others, the water continually running off, is supplied by new fresh river water, wherein the saline particles are so few, as by no means to be perceived. Now if this be the reason of the saltness of these lakes, it is not improbable that the ocean itself has become salt from the same cause; and thereby we are furnished with an argument for estimating the duration of all things, from an observation of the increment of salt in their waters; for if it be observed what quantity of salt is at present contained in a certain weight of the water of the Caspian sea, for instance, taken at a certain place, in the driest weather; and after some centuries of years the same weight of water taken at the same place, and under the same circumstances, be found to contain a sensibly greater quantity of salt than at the time of the first experiment, we may, by the same rule of proportion, make an estimate of the whole time wherein the water would acquire its present degree of saltness; and this argument would be the more conclusive, if by a like experiment, a similar increase in the saltness of the ocean should be observed; for the ocean, as was said before, receives innumerable rivers, which deposit their saline

particles therein, and are again supplied by the vapours of the ocean, which rise therefrom, in atoms of pure water, without the least admixture of salt; but rivers, in their long passage over the earth, imbibe some of its saline particles, though in so small a quantity as not to be perceived, unless in these depositories, and after a long period of time; and if upon repeating the experiment, after another equal period of time, it shall be found that the saltness is further increased with the same increment as before, then what is now proposed as hypothetical, would appear little less than demonstrative; but since this argument can be of no use to ourselves, it requiring very great intervals of time to come to the conclusion, it is to be regretted that the ancient Greek and Latin authors have not recorded the degree of saltness of the sea, as it was about two thousand years ago; for, admitting the truth of this hypothesis, the difference between what it now is, and what it then was, would become very sensible. If it be objected that the water of the ocean, and perhaps of some of the lakes might, at the first beginning of things, in some measure contain salt, so as to disturb the proportionality of the increase of saltness in them, the Doctor does not dispute it; but observes, that such a supposition would only by so much contract the age of the world within the date to be derived from the foregoing argument; and even then it might be found much older than many have imagined.

UNIFORM PENNY POSTAGE.

This measure, which was first regarded by many as an impracticable and visionary scheme, after closer investigation, was soon pronounced to be possible and desirable; and the increasing interest with which it is now contemplated by all classes; the powerful support it receives from the periodical press, and the unqualified recommendation of the Committee of the House of Commons, combine to render its ultimate adoption an event of imperative necessity. Nevertheless we again entreat our readers to exert themselves in the way of petitioning as described in a former number. With respect to economizing postage under the present system, as many persons might unintentionally transgress the law, the following extract from the report of the select Committee, will no doubt be acceptable, as it points out not only what may lawfully be done, but what really is practised to a great extent.

"*Effects of present Rates in occasioning evasion of Postage without breach of the Law.*

"The evidence clearly establishes the fact, that all classes of the community, each according to the means, direct or indirect, within its reach, use their utmost endeavours to correspond free of postage, and wherever it can be done without breaking the law. Of the lawful modes of evasion, the most direct and obvious is that by private messengers, which, in the case of insurance offices and other public institutions having circulars to distribute, is most extensively resorted to. Scarcely less direct is the use of Parliamentary and official franks; by means of which, Dr. Lardner, the editor of extensive literary works, transmits, as he states, the greater part of his correspondence. Invoices may lawfully be sent in parcels with the goods; and this, it appears, is the mode of transmitting such documents, which is very generally in use among tradesmen, though in many instances it renders them liable, in case of damage or loss, and, to the consignees, is almost universally productive of inconvenience. If it were not for the high rates, those documents would be forwarded by post to an immense extent. Among the less direct means of lawful evasion, are the following. Where a common piece of information is at the same time to be imparted to many, an advertisement in a newspaper, previously determined on, answers the purpose of many letters. The mere transmission of a bygone newspaper is the preconcerted signal of the occurrence of a certain event, which is thus made known to the party by whom the newspaper is received; or by a device, precisely analogous to the former, a letter is addressed to the party, which he declines to receive and pay for. By varying the modes of directing the addresses on such newspapers or letters, as many different occurrences may be notified as there have been signals previously agreed upon. A mode of making explicit communications, and evading the writing of letters and payment of the postage, is resorted to by factors in Ireland. They publish printed circulars showing the state of the markets in their own particular trade, which circulars being stamped as newspapers, are transmitted free of post. Their different correspondents are distinguished in the circular by different numbers, and opposite to these numbers are printed the communications which the factor wishes to make to his several correspondents. Another indirect mode in universal practice among

printers, booksellers, and publishers, and also very prevalent amongst other classes of tradesmen and mercantile men, is to write a letter to one firm containing passages intended for the information of other firms in the same town or neighbourhood, which passages are to be cut out into slips, and forwarded to those other firms. Exactly on the same principle, when money is due and is to be paid to several tradesmen in the same town, a remittance of the whole sum is made to one house, in order to be distributed amongst the whole."

INSTRUMENT FOR MEASURING THE SPEED OF A SHIP'S SAILING.

By M. A. Rivet.

This instrument is composed of a syphon bent outwards at each end, and placed parallel with the ship, so that the water may penetrate, and pass with a greater or less velocity, according to the velocity of the ship's motion. In the anterior vertical branch is a spiral, also vertical, to which the water communicates a motion, which is transmitted by means of wheels and pinions to a glazed dial upon the vessel. The velocity of the rotation of the spiral, is determined by that of the current which passes through the syphon.

We give this brief description of an invention which has more than once occupied the French Academy within the last few months; not that we consider it sufficiently accurate to supersede the log, but because it suggests the possibility of constructing an apparatus which would show, not only the distance performed in any given time, but also the drifting of a vessel contending against an oblique or contrary wind, and which would consequently determine the real direction of the ship's progress. If an instrument floating on the surface of the water, with a vertical paddle-wheel placed with its axis perpendicular to the line of the ship's motion, were attached to a line, it is evident that the velocity of the wheel's rotation would be proportioned to the velocity of the ship's progressive motion, supposing the water through which the instrument is drawn, to be quiescent; and if the ship had any lateral motion (which is most frequently the case) it would be indicated by the direction of the line. We do not propose this as a perfect instrument, but merely as a point of departure for future improvement.

HISTORY OF ARCHITECTURE.

NO. II.

According to promise, we will now briefly notice the progress of architecture in ancient Egypt, not only because it possesses some of the most ancient existing architectural remains, but because those remains denote at once to the eye of the wandering traveller, the splendour and magnificence of the cities once reared upon their site. They consist principally of ruined temples, shrines, pyramids, altars, &c.; in fact, almost the whole seem to have been either originally erected purposely for, or subsequently made subservient to, the purposes of an idolatrous worship. Historians, however, allow us to believe, that their architectural edifices consisted not solely of these, for they speak of "palaces, theatres, bridges, and many stately public buildings." The places known by the names of Thebes and Memphis, boast of most of the existing remains. Their dates are conjectured from the hieroglyphical characters generally adorning them, and which many persons have been at great pains and expense to decipher. Denon, an ancient writer, speaks of walls literally *covered* wich obscure hieroglyphical emblems. The earliest existing specimens are tombs, which are supposed to have been constructed seventeen and eighteen hundred (and some still more) years before Christ. These are excavations in rocks, mountains, or the like, and have received the appellation of hypogæa, or caves. They differ considerably in size; if small, nothing seems to have been made use of to sustain the weight pressing on their summits, but when of some extent, huge even blocks of the material were left to support the heavily pressing matter above. Advancing gradually, we find that hypogœa were constructed of still larger dimensions, and ornamented with porticos (of course bearing in their appearance a close analogy to the barbarity of the age). These were probably used as sanctuaries. On the banks of that justly celebrated river the Nile, there at present exist numerous remains (more or less in decay) of these excavations. The temples next claim attention, which are remarkable for their vast extent, massive structure, and surpassing grandeur. The following description by Hosking, of the temple of Edfou in Upper Egypt, will, I trust, be sufficiently explicit:—"The plan of the inclosure behind the propylœa (structures forming the entrance to the inclosure of a temple) is a long parallelogram, the moles, or propylœa themselves,

forming another across one of its ends. The grand entrance to the great court of the temple, is by a door-way between the moles, to which there may have been folding gates, as the notches for their hinges are still to be seen. Small chambers, right and left of the entrance, and in the core of the propylœa, were probably for the porters or guards of the temple; a staircase remains on each side, which leads to other chambers at different heights. To furnish these with light and air, loop-holes have been cut through the external walls, which disfigure the front of the structure. The court-yard, cloister, or vestibule, has on three of its sides a colonnade against the wall of the peribolus (inclosure), forming a covered gallery.

"The pronaos, or covered portico, consists of three rows of six columns each, parallel and equidistant, except in the middle, where the intercolamnation is greater, because of the passage through it. The front row of columns is closed by a sort of breast-work or dado, extending to nearly half their height, in which, moreover, they are half imbedded; and in the central opening a peculiar door-way is formed, consisting of piers, with the lintel and cornice over them cut through."

"From the pronaos (covered portico) another doorway leads to an atriumn, or inner vestibule, consisting of three rows of smaller columns, with four in each, distributed as those of the pronaos are. Beyond this vestibule there are sundry close rooms and cells, with passages and staircases, whose intention is not obvious."

He then goes on to say, that there is an innermost room, probably the adytum or sanctuary, the holy of holies, honoured by the presence of the divinity. Of the pyramids, only a word. These structures, the accounts of which have excited universal astonishment, possess no architectural beauty, but are noted simply for their immense size, vast antiquity, and mysterious design. Nicholson states that the arch was not used, and by that its principles were unknown to the Egyptians: for all their apertures are cut out of solid stone, rock, or the like.

Their walls are principally constructed of massive stones, without any cement, and the joints are rendered particularly even. Of Egyptian *house architecture*, little, very little is known, and we have every reason to suppose, that very little ever existed. The architecture of Egypt, taken as a whole, is characterised by a vastness and boldness of style belonging only to itself.

PROPORTIO.

HAYTER'S ROYAL CORONATION PICTURE.

In describing the works of art deriving their origin from the coronation of Queen Victoria, the first place must be given to the representation of that splendid ceremony by Mr. George Hayter, her Majesty's painter of history and portraits. We have been favoured with a view of the picture in its present state, and it may, perhaps, gratify our readers to give them a detailed account of a work which will, we think, prove in every way worthy of Mr. Hayter's high reputation. The great powers of the composition in subjects of this vast nature already displayed by Mr. Hayter, and for which he has long been justly admired by the lovers of the arts, have received scope for exercise in the arrangements of this gorgeous spectacle, while the justness of his taste is manifested by a strict adherence to truth. Indeed, so admirably disposed were the royal and distinguished personages most prominent on this imposing occasion—so varied in beauty, sex, and age—that no artist could desire a more splendid subject, or one more gratifying to his ambition, and affording a fairer field for the display of his abilities. The point of time represented in Mr. Hayter's picture, is that when his Grace the Archbishop of Canterbury, having placed the crown on the Queen's head, returned to the altar and commenced the exhortation to her Majesty amidst the most enthusiastic cheering from all parts of the Abbey, accompanied by waving of handkerchiefs and loud cries of "God save the Queen!" "God bless the Queen!" heard far above the pealing organ and the thunder of the cannon—the princes and princesses of the blood, the peers and peeresses, and the ministers of State simultaneously assumed their coronets, forming a scene which words are inadequate to describe, but which none who witnessed could ever forget. In the centre of a glittering assemblage of rank and beauty, our youthful Sovereign is seated on the throne of St. Edward, crowned, and holding a sceptre in either hand, while she regards the Archbishop of Canterbury with that air of sense and unaffected dignity which characterized her deportment during the whole of that glorious day's proceedings. The royal box, which occupies the greater part of the back ground of the picture, contains, besides their Royal Highnesses the Duchess of Kent, the Princess of Hohenlohe, the Prince of Leiningen, the Princess Augusta, the Duchess of Gloucester, the Duchess of

Cambridge, the Dukes of Sussex and Cambridge, and other august relatives of the Queen, with their ladies and equerries, the Duke de Nemours, the Duke of Saxe Cobourg, and several foreign princes who witnessed the ceremony. On her Majesty's right hand stands the Duke of Norfolk, hereditary Earl Marshal, and next him Lord Melbourne, holding the sword of State, is seen in the act of placing his coronet on his head. The Dukes of Wellington, Devonshire, and Sutherland; the Marquises of Westminster, Lansdowne, and Stafford, and the Lord Chancellor, with their pages, form a group extending from the royal box to the altar, on the step of which stands the Archbishop of Canterbury, with the Archbishop of York, the Archbishop of Armagh, the Bishop of London, and other dignitaries of the church on his right hand. The group immediately behind the throne (certainly the most attractive in the picture) is composed of numerous beautiful ladies, the lovely trainbearers, the maids of honour, and other attendants, in the most splendid and gorgeous costumes, and the Marquises of Anglesey, Conyngham, and Normanby; while near the Queen stand the Duchess of Sutherland, the Duke of Richmond, and the Lord Great Chamberlain, Lord Willoughby d'Eresby. The extreme right of the picture displays part of the south transept of the Abbey, filled with the peers of the realm, with the crowded gallery reaching nearly to the vaulted roof of the stately pile. The most picturesque use is made of the splendid Gothic fittings and decorations of the sacrarium, and by a judicious management of the light, so much harmony of effect is produced, that they support the brilliant colours of the robes and costumes of the pageant. The magnitude of the picture, and the size of the figures, are proportioned to the grandeur of the subject, and the composition is well worthy the deservedly high reputation of the artist. Not only has he had an admirable scope for his imagination, but he has been honoured with repeated sittings from all the royal and noble personages introduced, which alone accounts for the marvellous fidelity of the portraits. We shall look forward with some anxiety to the completion of this work, which, doubtless, will rank among the finest historical pictures of the age. Messrs. Hodgson and Graves, her Majesty's printsellers, have undertaken to engrave it in a style worthy its great merits.—*Morning Herald.*

OBSERVATIONS ON ANTS.

Dr. King observed three sorts of ants, commonly without wings: *viz.*—very black; dark brown; and a third species, resembling the colour usually called *feuille marte* (dead leaves). Each species dwell apart in separate banks; two sorts being seldom or never found together, there being a kind of enmity between them. Upon opening these banks, there is observable a white substance, like grains of fine white sugar, or salt, but very soft and tender; and, if you lay a bit of it on the object-plate of a good microscope, and open it with the point of a needle, you may discern many pure, white, and clear appearances in distinct membranes, resembling the eggs of the leper sort, and as clear as a fish's bladder. This very substance he found in the bodies of the ants themselves; and he takes it to be the true ants' eggs. They are observed to lie in numbers upon it; and, in a little time, everyone of them becomes a little worm, without any perceptible motion: but, in a few days more, they discover a feeble motion of flexion and extension, and then they look yellowish, and hairy; in shape, resembling a small maggot: and, so retaining that shape, grow almost as big as an ant, with everyone a black spot on it; then they get a whitish and oval film all over them: for which reason, they are commonly called ants' eggs, though they are not properly so. Some of them he opened, and found a maggot only; in others, a maggot beginning to put on the shape of an ant about the head, with two little, yellowish specks, in place of the eyes; in others, he found a further progress, as being furnished with everything to complete the shape of an ant, but wholly transparent, except the eyes, which are then as black as the finest jet: but when they newly put on this shape, he could never discern the least motion in any one part of the little animals; which may be owing to the weakness of their fibres: for afterwards when they turn brownish, they have strength to stir all their members. Upon carefully opening some of these reputed eggs, he took out of several of them perfect and complete ants, which immediately crept about; only differing from other ants, in the feeble motion of their limbs: and this is a proof, that the film only covers a maggot while it is transforming into an ant, and till it is fit to shift for itself. The black speck he supposes to be emitted from the body of the maggot in its transformation, since after it becomes an ant the speck disappears. It is observable, how

upon breaking up their banks, their principal care is to secure their young, carrying them out of sight, and laying the several sorts of them in several heaps; and they know their young so well, that it is not possible to deceive them by small particles of any white substance similar in appearance. In a summer morning they bring up those of their young (that are vulgarly called eggs) to the top of the bank, generally on the south side, until five or six in the afternoon; but towards seven or eight in the evening, if it be cool, or likely to rain, you may dig a foot deep before you can find them.

If you lay bare an ant hill with a stick, and then throw chicory flowers on it, the flowers will become red as blood; Langham mentions this in his "Garden of Health," but he was not the first who observed it. Hieronymous takes notice of the same thing, and before him Otho Brunsfelsius, according to John Bauhinus; but they give no account of the manner how the flowers came to be stained, which is this; upon throwing in the flowers, you will observe the ants creep very thick over them, at which time they let fall a drop, which, wherever it lights, produces a large red stain; and bruising the ants, and rubbing the expressed juice on the flowers, has the same effect; and Dr. Hulse thinks, that the smarting pain they cause in the skin is owing to this corrosive liquor, rather than their stinging; but to what class he should reduce this juice, he was at a loss to determine. In some countries, especially on the mountains of Switzerland, where the ants are full half an inch in length, and sometimes considerably more, it is the custom with many persons to eat them, or, at least, to swallow the juice of them, when no water can be had to allay their thirst; the acid which they contain is strong and pungent, and by no means unpleasant to the taste, resembling very much the taste of lemon-juice. If lead be put into an infusion of ants, good *saccharum saturni*, or acetate of lead, will be formed. When you put them into water, they must be well stirred; for when irritated, they will spirt out their acid juice, and a portion of it would be lost.

ENORMOUS TURTLES.

THREE turtles, taken at Ascension Island, have been brought by a whaler, and landed at Havre, in France. The following account has appeared in a French paper:—One of them died almost the moment of its arrival, and was purchased by a dealer who has distributed the flesh to the numerous amateurs of a meat which is held in high estimation in several countries. Another is still living at Havre, and will probably meet the same fate as the former. The third, on the contrary, though especially destined for the tables of the proprietors of the ship, has been conveyed to Paris under the care of M. Bullot, administrateur of the Royal *Messageries* (stage coaches), who would not allow an object so rare and precious, to be destroyed and lost to science, and has presented it to the menagerie of the Museum of Natural History. The weight of this gigantic reptile is 500 pounds; its length is near five feet, and its breadth, following the convexity, is above three feet. Its head is as large as that of a child seven or eight years old. The day after its arrival at the Menagerie, it laid several eggs; they were white and perfectly spherical, and will probably be followed by many others. It is not impossible that young ones will be obtained; and their examination at different periods of their development, will be highly interesting.

It is to be regretted that these turtles were not sent direct to England; for it is evident they have fallen into the hands of persons unacquainted with their proper use. If they had been brought at once to London, their heads would have been removed, and then the under shells taken off, with a sort of flesh adhering to it, which resembles fowl, and is called "callepee." Then their insides would have been carefully extracted, and the guts well washed; many consider this the finest part of the turtle. The flesh in the upper shell is called "callepash," with a kind of greenish fat, which is much esteemed. All these things in the hands of an erudite London cook, would have been converted into delicious food, worthy of being placed before those respectable and respected individuals, who are even proverbially so fond of it.

THE VAPOUR BATH.

To the Editor of the Mechanic and Chemist.

SIR,—Having noticed in one of your pages a plan of a portable vapour bath, I am induced to send you a few observations on that subject, if you think them worth inserting.

The vapour bath is the most effectual remedy for colds, and is universally adopted in hot climates, and even in the cold

regions of the north, in Russia, Lapland, Sweden, Norway, and Denmark, where it is in high estimation for promoting health and beautiying the complexion; indeed there is no cottage so poor, no hut so desolate, but it possesses its vapour bath, in which its inhabitants experience both comfort and salubrity; and it makes so necessary a part of the system of living, that it is used by people of every age, and in all circumstances, by infants, and by women at their lying-in; in almost all sicknesses, before and after a journey; after hard work or excessive exercise, to obviate the effects of fatigue.

I am, Sir, your obedient servant,
E. Brent.

IMPROVEMENT ON THE FOOT-LATHE.

(See Engraving, front page.)

Sir,—Being a constant reader of your valuable work, and seeing that you encourage mechanics to communicate to each other the ideas which may strike them in the pursuance of their work, I take the liberty of sending you the accompanying sketch and description of a plan, to enable turners, who have only a common foot-lathe, to turn rings, &c., of a large diameter on an easier plan than I believe to be generally practised; which, if you think it worthy of it, your insertion of it in an early number will much oblige

Your obedient servant,
G. A. N.

Description of the Drawing.

As the construction of the lathe-beds, sling, &c., is the same as usual, I shall only particularly describe the additions, &c., viz., A is a wood rigger, fixed on the end of the sling, for the purpose of driving the work; *b s c*, are two pieces of wood, fixed to the back of the lathe, to screw the two iron pullies, *e* and *d*, into; *f* is the puppet-head, removed from the usual place, and fixed near the other end of the lathe, at right angles to the beds, so that the nose of the mandrel projects over the front of the beds; the cord, 1, 2, 3, 4, 5, runs in the direction of the arrows from the back of the rigger, *a*; behind the beds, and the pulley, *d*, over the pulley, *e*, to the bottom of the rigger on the mandrel, over that, and then over the pulley, *d*, to the front of the rigger, *a*; when the puppet, &c., is placed according to the drawing, a ring, &c., may be chucked on the end of the mandrel, of four or five feet diameter, as may be seen by the ring, chucked on a cross, running over the front of the beds, as represented by the dotted lines at *g h i*, with the tool-rest placed in the usual position.

ARTESIAN WELLS.

M. Leplay, engineer of mines in the vicinity of Bonn, has addressed, to the French Academy, a memoir on the apparatus employed in piercing Artesian wells. It is known, that the drills composed of several pieces, united by means of articulations, so as to form a single rod, present many inconveniences: in the first place, their weight is excessive; that which is used at the *Abattair de Grenelle*, (described in a former number of the " Mechanic ") does not weigh less than 230 or 240 *quintanx* (hundred weights.) The consequence is, that, by the shock against the rock, the iron at the joints is forged out in the manner of a rivet, and is engaged in those parts of the aperture which pass through a hard rock; and the rod, by its lateral vibration, causes injury to the surface of the tube, and even to the rod itself: these difficulties render it almost impossible to descend beyond a certain depth, M. Leplay could not descend farther than 250 mètres. The drills attached to a cord, are subject to another inconvenience: the liability of separation from the cord. He has now conceived a plan of disposing the mode of junction of the lower, with the upper part; so that they can re-enter after the stroke: by this contrivance, the difficulties, experienced in the old method, are avoided. This simple modification has enabled M. Leplay to descend 403 metres: and his apparatus weighed only 3,405 kil., instead of 6,1416 kil., which it would have weighed in the old system; in consequence of the necessity of making the pieces which compose it, stronger, and consequently heavier; in order to enable them to support the greater pressure.

LONDON AND SOUTHAMPTON RAILWAY.

The Tunnel on Shapley Heath, a short distance beyond the point to which the road is now opened, has in part fallen in, and will delay the continuous opening to Basingstoke for about a month. One advantage will result to the public from this accident, that instead of proceeding through a tunnel, they will have an open cutting.—*Hampshire Independent.*

THE CHEMIST.

THEORY OF SUBSTITUTIONS.

Organic chemistry now possesses a certain number of rules and theorems, which, comprising a great mass of well-established facts, elevates this branch of knowledge to the rank of a true science. But besides these uncontested principles, there are certain views which create discussion, and which have been the object of important communications to the French Academy. The constitution of organic acids, and the theory of substitutions, are amongst the number. It has been recognized for some years, that an hydrogenated organic substance which was submitted to the action of oxygen, chlorine, brome, or iode, looses hydrogen under their influence, almost always takes a quantity of oxygen, chlore, or iode, equivalent to that of the hydrogen which it abandons. It is then said that *substitution* or *metalepsy* has taken place; and, in fact, the chlorine, for example, which is thus engaged in the new product, looses its characteristic properties; it no longer discolours, it is no longer precipitated by the nitrate of silver, nor absorbed by the alkalies; it becomes latent, and can only be found again after the total decomposition of the matter brought back to its organic elements. The theory of equivalents is insufficient to explain these curious facts: provided the quantities of chlore and hydrogen retained or lost by the body, may be expressed by any equivalents whatever, this theory is satisfied; but in a metalleptic reaction, it is necessary that the hydrogen taken away should be exactly replaced, equivalent for equivalent, volume for volume, by the chlorine, brome, or iode. The principal objection of M. Berzelius to the theory of substitutions, is founded on the difference which exists between the electrical properties of the bodies in question. The illustrious Swedish chemist cannot admit that a body so remarkable as hydrogen for its electro-positive properties, can be replaced by bodies the most electro-negative with which we are acquainted. M. Dumas, before he communicated the reflections which this objection had suggested, had again recourse to experiment, and sought in nature herself, decisive facts. He was thus led to the discovery of a remarkable organic acid, by replacing hydrogen by chlorine in acetic acid, without notably altering the essential characters of the substance. Its acid power was not changed; it saturated the same quantity of bases as before, and saturated it equally well, and the salts which it produced, compared with acetates, offered a resemblance which is highly interesting. Now if metalepsy enables us to foresee the formation of these extraordinary combinations, if it explains their properties, and teaches how to produce them, it is of little consequence that this theory deranges something in ideas which were formerly admitted in science: it constitutes a new mode of reaction, a law of nature, which must henceforth be taken into consideration.

Chloracitic Acid.—To obtain this, M. Dumas introduces dry chlorine into bottles capable of containing five or six litres, and adds acetic acid (crystallizable) in the proportion of nine decigrammes at most, to each litre of chlorine. Under the influence of the solar light, white vapours are developed, small drops of a dense liquid are condensed in the upper part, and the chlorine gradually disappears; the reaction is seldom rapid enough to cause the explosion of the bottles. On the following day, the interior of the bottles is coated with a crystallized substance, partly in regular rhomboids of a large size, and partly in the form of a hoar frost; at the bottom of the vessel, remains a quantity more or less considerable, of a dense liquid, oxalic acid, and, as gaseous products, chlorhydric, and carbonic acids, and perhaps also chlorocarbonic acid. The bottles are washed with a small quantity of water, and the solution is evaporated *in vacuo* between two vessels filled with concentrated sulphuric acid, and the other with caustic potass. The distillation with anhydric phosphoric acid, operates the separation of the water, the decomposition of the oxalic acid, and the volatilization of a small portion of acetic acid which remains unaltered. The last products which pass into the receiver are constituted by the chloracetic acid, and rapidly assume the form of a crystallized mass.

Chloracetic acid is colourless, with little odour in the cold, of a sharp and caustic taste, and very deliquescent; it whitens the tongue, and, by a prolonged contact, it produces a blister. It melts at a temperature exceeding 46o, and boils at 195° or 200o. The vapour of this acid is very irritating and painful to respire: it does not discharge vegetable colours. Its density, taken at its point of fusion, is equal to 1.617. The analysis of this remarkable substance leads to a formula which only differs from that of hydrated acetic acid, in the hydrogen being completely replaced by chlorine. The chloroacetate of potass, obtained by neutralizing the carbonate of this base with the new acid, and abandoning it to spontaneous evapo-

ration, crystallizes in silky fibres, unchangable in the air; which distinguishes this salt from the acetate; which is known to be exceedingly deliquescent: it is decomposed with explosion, when exposed to a slight heat. M. Dumas describes several other experiments; all of which tend to prove, that the chlorine, in replacing the hydrogen, does not alter the properties of the compound, be it acid, or base, or neuter compound. In this system (which, it must be observed, is dictated by facts) the electro-chemical theory is neglected; but the polarity attributed to the molecules of simple bodies, is not founded on such evident facts, as to entitle it to be considered an article of faith. Far from that, the surest guide in mineral chemistry, is *isomorphism*: a theory founded upon facts, and ill according with the electro-chemical theory.

CHLORIDES AND SULPHURETS OF ANTIMONY.

To the Editor of the Mechanic and Chemist.

SIR,—Sesquichloride of antimony (the only chloride of importance) is a soft solid at common temperature; on that account, it is sometimes called butter of antimony. It may be brought to the liquid state, by the aid of a very gentle heat. It crystallizes on cooling; but deliquesces on exposure to air. When this substance is mixed with water, decomposition ensues: the oxygen of the water unites with the antimony, forming sesquioxide of antimony; which, from its insolubility, is precipitated; the hydrogen combines with the chlorine of chloride, forming hydrocloric acid; which remains in solution. This may be proved to be an oxide, by a slip of litmus test paper; and, on the addition of a few drops of nitrate of silver, the chloride of silver falls: (the solution, previous to adding the test, must be pressed through a filter, to separate the oxide of antimony,) clearly proving the presence of hydrochloric acid. It may be prepared by dropping powdered metallic antimony into a jar of chlorine gas; (the jar, for this purpose, must be provided with a ground stopper to introduce it,) rapid combustion takes place, falling in the form of brilliant stars; forming a very interesting experiment. It may also be prepared, by distilling two parts of finely powdered antimony with five parts of bichloride of antimony in a glass retort with a receiver attached, which must be kept cool: the sesquichloride of antimony condenses in the receiver, and the metallic mercury remains in the retort.

Perchloride of antimony is prepared, by passing chlorine gas over metallic antimony while heated. It is a clear, volatile liquid, which fumes on exposure to air. Like the sesquichloride, it is decomposed by water.

Sesquisulphuret of antimony, (the common antimony of the shops) sometimes called black antimony, is, occasionally, found crystallized. It has specific gravity of 4·62. Its colour is grey, with a redish tint; its lustre is metallic. It may be fused in a covered crucible without change. It is formed, when antimony and sulphur are fused together; it is also formed, when sulphuretted hydrogen is passed through a solution of tartar emetic. In this case, it falls as a hydrated sulphuret of an orange-red colour: on this being exposed to heat, it turns to the dark colour of the native sulphuret; its water being expelled.

Oxysulphuret of antimony may be prepared, by boiling the native sulphuret in a solution of potass or soda; the liquid thus obtained, on cooling, deposits an orange-red matter, known by the name of Kermes mineral. On the addition of a little acid, a second deposit takes place. The existence of this compound is much doubted by many chemists; who state it to be no more, than the hydrated sesquisulphuret: which, I have no doubt, is correct.

A. TAYLOR.

Instantaneous Crystallization.—Put into two ounces of boiling water as much sulphate of soda (Glauber's salts) as will dissolve (about three ounces). While this saturated solution is still boiling hot, pour as much of it into a phial as will nearly, if not quite fill it, cork the phial closely, and let it stand to cool; when it is perfectly cold, the solution still remains fluid; but, draw the cork, and that instant the whole will become a confused crystalline mass, and will evolve a considerable quantity of heat. The same experiment may be repeated any number of times with the same salt. P. T.

Art.—M. Colas has found a method of applying to statuary, a proceeding analogous to that of M. Daguerre. By it he produces a copy of any size, and retaining the proper proportions, in marble, stone, ivory, wood, alabaster, porphyry, azote, &c. His mechanical powers are said to be so perfect, that the imperceptible alterations in the marble, occasioned by time, are reproduced.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, May 15, H. Brown, Esq., on the Writings and Genius of Sterne. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, May 14, E. Dowling, Esq., on Criticism. At a quarter to nine.

Poplar Institution, East India Road. Tuesday, May 14, Mr. Thorne, on the Fine Arts. Friday, May 17, Discussion, Social System.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, May 16, a Discussion. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, May 13, Mr. Morton, on Mechanics. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, May 16, Southwood Smith, M. D.. on Organization and Life. At half-past eight.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir, Will you have the goodness to inform me how I can melt Indian rubber, so that I can cast ring balls, &c.? I remember having some time back seen a note in your invaluable magazine, the directions of a person who had two cylinders and cranks for sale. I think it was in Holborn, but do not know where.

Blackfriars-road. G. B. W.

[Indian rubber is most conveniently dissolved in naptha; but it is also soluble in ether and essential oils.]

Sir, Can you or any of your numerous correspondents inform me of the best method of rendering muslin transparent? I have tried several methods from books, and find, that when folded up, it sticks to such a degree, as to render it scarcely possible to separate the muslin; and other places crack so much, that the medium becomes almost useless. S.

Sir, Can any of your chemical correspondents inform me, through the medium of your valuable magazine, how to make the sulpho-cyenide of potassium? The use I want it for is, as a test for iron, with which it gives a blood-red colour.

A. Taylor.

Sir, Will you or any of your numerous correspondents inform me, why there is more rain in the months of March and April, than in the months of July and August? Also how to make wafers? How to prepare nitrate of silver?

R. S. E.

Sir, As I intend shortly to perform some experiments, I shall feel obliged if you or any of your numerous correspondents will inform me which is the best treatise on optics and optical instruments, and where it can be purchased?

P. T.

Sir, Can any of your correspondents inform me where to obtain the cement made use of to unite the gores of a balloon, and what ingredients are required to make it? G. H. S.

Sir, If you or any of your numerous correspondents will answer the following questions through the medium of your valuable publication, you will much oblige several of your subscribers, including your obedient servant,

J. S. E. L.

1. How to temper springs for gun-locks? 2. How to etch on glass? 3. How to tin sheet iron? 4. How to make German silver? 5. How to make and use French polish? 6. How to make black varnish for leather? 7. How to make gold size? 8. How to make and use the composition for silvering clock faces? 9. How to impregnate the needle of a mariner's compass? 10. Which is the best method of mixing brass, so as to make it soft and easy to turn; also, to make it susceptible of a good polish? 11. What is the best material in which to cast lead, to give it a bright glossy surface? 12. Which is the best method of forming the teeth of wheels? Grier's "Mechanic's Calculator," gives two methods, one of which refers to the letters *c* and *e*, which letters are not to be found in the accompanying diagram; it also states, that a line must be drawn on the surface of the teeth for the pitch line of their point of action, but neglects to inform us whereabouts it ought to be. The other method is equally deficient. 13. How to bronze iron?

1. *To Temper Springs for Gun-locks.*—[1. In hardening steel, care should be taken that no greater heat be applied than is necessary to affect the hardening when plunged into water or oil; the heat varies in different qualities of steel, and must be found by trial. When the article is of a delicate form, likely to be thrown out of shape, oil is preferred, as warping the metal less than water. The best way to temper steel, is to clean it after it is hardened, and then blue it; the colour which gives the proper temper, also varies in some degree in different kinds of steel; but the heat usually applied, and which is never far wrong, is a pale blue. At this heat lead will melt, and the tempering is sometimes operated by immersing the spring, &c., in melted lead, and when the lead runs off and leaves the steel clean, it has attained the required heat. The most common, and the easiest method, is to dip the article in oil or grease, and hold it over a fire till the grease begins to smoke, so that it will burn when a light is applied to it; this is the proper temper; but care must be taken not to let it burn too long, for if there are any slender parts, they will be softened by the heat of the flame.

2. *To Etch on Glass.*—Cover the glass with a thin coat of wax, and trace the design with a point; then expose the surface to the vapour of fluoric acid, and all uncovered parts will be eaten away. Fluoric acid is usually preserved in leaden bottles; it should be kept very carefully stopped, otherwise, if placed in a cupboard, it will spoil all the glass within the cupboard, by destroying its polish.

3. *To Tin Sheet Iron.*—When the iron is made perfectly clean, dip it in a solution of sal

ammoniac, and then into melted tin; when it is withdrawn, it will be found covered in the manner of common tin plate.

4. *To make German Silver.*—German silver is a mixture of copper, zinc, and nickel. The Germans have a superior quality of the latter ingredient, which renders their mixture superior to ours.

5. *The Method of Making and Using French Polish,* is described in a back No. of the "Mechanic."

6. We are not in possession of the proper receipt, but if not supplied by some of our correspondents, we will endeavour to obtain it.

7. An eminent bronzer assured us, that it was not worth his while to make his gold size, as it is sold at a cheap rate; judging from its appearance and smell, we should pronounce it boiled linseed oil, and turpentine.

8 & 9 must be deferred till next week, as we have a good deal to say on those subjects.

10. *To make Brass.*—Six ounces of zinc to one pound of copper will make excellent brass, possessing the properties required by our correspondent. The zinc should be put in after the copper is melted, and plunged at once to the bottom of the crucible; if it is allowed to remain on the surface, a great portion will be lost, as it is exceedingly volatile.

11. The sand prepared and used by founders, will give a very bright surface to lead.

12. This subject requires diagrams, and must be treated at some length to be understood. The epicycloid is the form which has been adopted till recently; but a spiral curve is now preferred by many.

13. *To Bronze Iron.*—Gold size and turpentine, coloured a dark green or brown as desired, then lay on the bronze dust with a pad of linen rag, and put the article in a stove till it is dry and hard. There are different methods of bronzing; some bronzers thinking, or pretending to think, that they are the sole possessors of mysterious secrets; but the essential basis of all durable bronzing on iron, appears to be linseed oil. —Ed.]

ANSWERS TO QUERIES.

Cement to fix the Plates in the Galvanic Trough.—"A Young Experimentalist" is informed, that the cement for fixing the plates in a galvanic trough, is composed of 5 lbs. rosin, 1 lb. bees' wax, 1 lb. red ochre, and two or three table spoonsful of plaster of Paris, or in proportion. To fix the plates, first put them half way into the trough, then pour in cement till about a quarter of an inch deep, and immediately press the plates home; when set, fix a narrow piece of wood on the edge of the trough, so as to form a channel; lay the trough on one side and pour in cement: proceed in same manner with the ends.

(ANOTHER METHOD).

"A Young Experimentalist," No. 16, may fasten the plates in the galvanic trough with the cement mentioned in my second paper on electricity in No. 14; or with a composition of 6 lbs. of rosin, 1 lb. of red ochre, 2 lbs. of plaster of Paris, and a quarter of a pint of linseed oil.

ELECTRON.

Sympathetic Inks.—"W. M. B—r." For sympathetic inks, use muriate of cobalt for green, acetate of cobalt for blue; and muriate of copper for yellow. "W. M. B—r." is mistaken in supposing the liquids "colourless," or even that they appear their original colours; for muriate of cobalt is a pale pink colour, the acetate a rose red, and muriate of copper, green. Some valuable information on this subject may be found in No. 83 of your useful publication. Some sympathetic inks may be rendered permanent. Writing or drawing with almost any solution of the metals will remain invisible, but instantly appear if prussiate of potash be bruised over them. The colours differ with the metals. Iron will produce blue, copper, brown, &c. Writing with muriate of copper will become blue, by being held over a saucer containing liquid ammonia. Writing with tincture of galls will become permanently black, on any solution containing iron being applied. Weak acids, such as lemon juice, &c., form invisible writing, which will become permanently black on being exposed to the fire. The chemicals may be purchased at any operative chemist's.

THOMAS BAILEY.

SIR, In reply to "J. J." in your last, permit me to state, that ink in most cases becomes mouldy from being poured into a wet or damp receptacle. Were the vessel rendered perfectly dry prior to the ink being inserted, little danger would exist of its getting mouldy.

PROPORTIO.

To make Sealing Wax. "James Lee." The best Dutch sealing-wax is made by melting four pounds of light-coloured shell lac, adding first one pound of Venice turpentine, and then three pounds of Chinese vermillion, stirring all well together; and when it is nearly set, a quantity sufficient for six sticks is taken and weighed. The sticks are made on a marble slab, fixed in a frame, with a chafing dish placed under the slab to keep it properly heated. The sealing-wax is first rolled upon this slab with the hands, until it is reduced to a roll nearly the length of six sticks, and then brought to the exact length, by being rolled with a square piece of hard wood with a handle. The sticks are then transferred to another workman, who rolls them upon a cold marble slab, with a marble roller, until it is quite cold, and then polishes it by holding the stick between two charcoal fires, placed at a small distance opposite each other, until the surface is become smooth, by beginning to melt, keeping the stick constantly turning. As the long stick grows hard, the lengths of each of the six future small sticks are deeply indented in their proper places. A third workman breaks the long stick into small sticks, and finishes them by holding the ends to the flame of a lamp. Oval sealing-wax is made by pouring the mass into steel moulds.

To make White Copal Varnish. "P. Truman." On 16 oz. of melted copal, pour 4, 6, or 8 ounces of linseed oil, boiled, and quite free from grease. When they are well mixed, take them off the fire, not forgetting to stir them properly; and when pretty cool, pour in 16 oz. of the essence of Venice turpentine. Pass the varnish through a cloth.

To make Black Varnish.—" P. T." Black varnish for coaches and iron work is composed of 12 oz. of amber, 2 oz. of rosin, 2 oz. of bitumen of Palestine, melted separately, and afterwards mixed; 6 oz. of oil is then added, and afterwards 12 oz. of the essence of Venice turpentine, as directed above. I think " P. T." will find this answer his purpose better than the one proposed by " J. A." in No. 119 T. J. B.

On Blue Writing Fluid.—" A. Kensett," No. 11. By the mixture of prussiate of potass and copperas, a decomposition takes place. The prussic, or, correctly speaking, ferrocyanic acid leaves the potass, and unites with the iron of the copperas, while the sulphuric acid, which is the other constituent of copperas, seizes the potass. By this means sulphate of potass is formed, which remains in solution, while the ferrocyanate of iron, or Prussian blue, is precipitated, unless some viscid matter, as gum, is present to keep it suspended in the fluid. Now there are two kinds of ferrocyanate of iron; the white, formed when the iron is combined with the least quantity of oxygen, and the other the blue, when the iron is united with its maximum of oxygen, or, in other words, when it is in the state of peroxide. It often happens, that the protoxide of iron is the basis of the copperas, or still more frequently a mixture of the two oxides, consequently the precipitate varies in colour, as the case may be. The best way to obtain the blue, that I know of, is to mix about half as much alum as you use copperas, or a little sulphuric acid, together, before you add the prussiate of potass; by this means I have never failed in the preparation of this ink. As I furnished the recipe your correspondent complains of, I think it incumbent on me to give the foregoing explanation.

" O. S." I thank him for the experiment mentioned in his query, being quite a novel one to me. The cause is this:—Prussiate of potass, or ferrocyanate of potass, is composed of carbon, azote, iron, and hydrogen, which uniting in certain proportions, form the ferrocyanic acid and potass. Now when nitric acid is added to this, it seizes the potass, forming saltpetre, or nitrate of potass, and then part of the acid is decomposed by it, a nitrate of iron most probably being formed, when, if any ferrocyanate still remains, it decomposes this newly-formed salt of iron and Prussian blue is consequently precipitated.

ELECTRON.

TO CORRESPONDENTS.

J. B. Clegg's *system of locomotion, which has been mentioned in the newspapers lately, was described in the " Mechanic" about a month ago.*

W. W. S. *Evaporation will not make new wine appear like old; it would only deprive it of the beauty of its aroma, and the virtue of its spirit.*

Veritas *is informed, that the history of the Birmingham Railway is in progress, though we regret we have been unable to publish it so soon as we had anticipated. We hope to devote our next Supplementary Number to it.*

Electron. *We regret that we cannot adopt the suggestions of our worthy correspondent; he wishes the queries proposed in this publication, to be designated by numbers, instead of recapitulating the substance of the question; a line or two might undoubtedly be economized by this means, but the answer appearing without any indication of the subject to which it refers, would be unintelligible without a reference, always inconvenient, and sometimes impossible, at the moment, to previous numbers.*

A. B. *proposes a plan to protect water-gilders from the pernicious effects of mercury to which they are continually exposed, not only by contact with the skin, but by inhaling minute particles condensed from the vapour. The workman is to wear a belt inclosing a quantity of sulphur, or thin sheet lead is to be worn about the clothes; either of which our correspondent thinks would attract and combine with the mercury: combine, they might, with such particles as happen to be thrown upon them, but they will not in any degree attract the noxious metal from other parts; the plan will not, therefore, succeed. There are not many gilders now, who work without the protection of a glass frame to screen them from the fire during the evaporation of the mercury; and attention to washing, and, if possible, changing clothes, after work, will at least mitigate the deplorable effects which result from negligence; but it is very much to be desired, that some more effectual remedy should be devised.*

A. B. (Chelsea). *The white veins in oak graining, are produced by removing the outer coat, and exposing the lighter surface beneath; the colour used for this purpose must be mixed with turpentine, which will dissolve the colour wherever it touches, and those parts of the outward dark coat may be wiped off. We cannot discover the intention of his other query.*

A Correspondent desires to know, 1st. Who invented logarithms? 2nd. What is the cause of water-spouts?—1. Lord Napier; 2. A vortex or tourbillon in the air, which cannot be explained by any of the causes of ordinary wind. It is generally considered as an electrical phenomenon, produced under peculiar circumstances, which, of course, are minutely described, agreeably to the established practice of philosophers, who, when they invent a theory, spare no pains to render it interesting by elaborate fabrications and visionary testimony, especially when it has no foundation in, or resemblance to truth, Those systems of Des Cartes were most admired which were not adulterated with any truth whatever; such as his favourite vortices, and other flights of fancy, unshackled by reference to nature.

Answers to the Queries of Coles—R. S. L.—F. E. L., *&c., in our next.*

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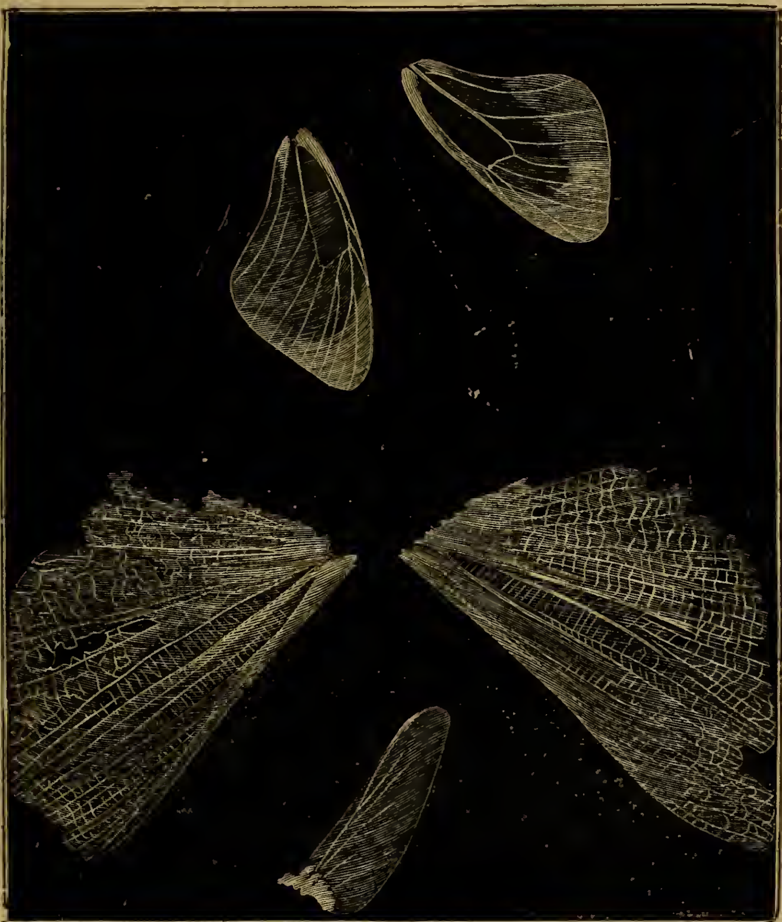
SPECIMEN OF MR. ACKERMANN'S PHOTOGENIC DRAWING.



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ACCIDENTS TO STEAM VESSELS.

The following is extracted from a letter addressed to the President of the Board of Trade, by Captain E. Chappell, R. N. It was written with the sanction, and under the authority of the Lords Commissioners of the Admiralty.

Accidents peculiar to steam vessels, arise principally from *collision* with other ships, *explosion* of boilers, *racing*, *burning*, or *sinking*. The author treats upon each of these heads, consecutively; but our limited space will only allow us to lay before our readers the substance and results of his observations.

1st. *Collision.*—This is unquestionably the most prominent, if not the most fatal source of steam-boat disaster. In crowded navigation, particularly at night, accidents from this cause are almost of weekly occurrence, occasioning incessant risk of life and injury of property. The greatest danger of collision is at night, and it is here that the legislature might interpose its authority with the most beneficial effect. The grand object is to secure UNIFORMITY as to the lighting of steam vessels. At present every steam vessel is lighted according to the judgment or caprice of the owners, agents, or commanders. At Liverpool alone, no fewer than eleven different methods of lighting are practised. After full and anxious personal observation, and by inquiries of all the mail packet commanders under his superintendence, they were *unanimously* of opinion, that steam vessels of all classes should be lighted uniformly at night with one bright light at the foremost head, one strong bright light in a light room affixed before and to the starboard paddle-box, and a strong red light in a light room, similarly placed at the larboard paddle-box. The bow, or paddle-box lights, to have two circular lenses each, of at least thirty-six inches in circumference, with a good lamp and reflectors facing each lens; one lens to be inserted at a right angle with the vessel's keel, throwing the light directly a-head; the other inserted parallel to the side of the paddle-box, throwing the light a-beam. To give the red colour to the larboard bow light, the lens must be made hollow, and filled with a *mineral* liquid, as in the City of Dublin Company's steam vessels. Liquids coloured by *vegetable* preparations, being found to be more opaque. The precaution must also be taken to construct a projection or shade in a line with the keel, and on the inside for a few feet before each bow light, to secure the light from dazzling men on the forecastle, and also to prevent the light of one bow being seen by a vessel on the other bow. If this plan were universally adopted, it would be known, that on seeing one bright light over another bright light, the strange vessel's starboard bow is presented; if a bright light is seen over a red light, the larboard bow is presented; and if a bright light is seen over a bright and a red light, forming a kind of triangle, the strange vessel is steering directly for the spectator. This certainty as to her position, added to a knowledge of the regulation as to passing on the starboard side, when practicable, will give what is now so much required—a mutual understanding between the two commanders or steersmen as to their respective *intentions* in situations of surprise or difficulty. productive of great relief to the mind of the mariner, and considerable additional safety for the lives and property entrusted to his management.

2. *Explosion of Boilers.*—This is not so common an occurrence in Europe as in America, owing to the different amount of pressure used on either side of the Atlantic; but as some very lamentable cases have recently occurred in Great Britain, and as it is now more than heretofore the practice to use steam *expansively* with increased pressure upon boilers, Captain Chappel strongly recommends the enforcement of a few simple precautions; one of these would be, to compel every steam vessel, after a given day, to have two separate safety valves; one of which properly weighed, should be *inaccessible*. By this means, the chance of a boiler being burst by sticking or other derangement of the valves, would be placed beyond the reach of probability. The horrible calamity which took place by explosion of a steam boiler at Hull, is supposed to have been occasioned by the engineer letting the water go too low in the boiler, which caused the generation of a highly explosive gas. This might be prevented by merely having a pipe communicating with the steam whistle inserted in the top of the steam boiler, and carried down through the water so far, that, should the steam find entrance, it would sound the whistle, and give instant notice of the danger to every person on board.

3. *Racing.*—This cannot be too severely prohibited, particularly if there be only one safety-valve, and that accessible. I have known (says Captain Chappel) an instance in a private steamer, of the engineer standing on the safety-valve to increase its weight, nor could he be induced to remove, till one of the passengers threatened to knock him off with a handspike. This overloading would effectually be put

a stop to, by a regulation I have suggested, compelling every steamer to have one safety-valve out of the two *inaccessible*. In one case of racing, where I was aboard as a passenger, the vessels came alongside, so that their paddle-boxes bore against each other. One vessel, in trying to cross upon the other, kept the helm hard a-starboard, and the other hard a-port, the engines of both going with full power; but the vessels remaining almost stationary (i. e. relatively), heeled over on either side, to the great terror of the female passengers; and in this state they continued for above an hour, owing to the obstinacy of the commanders. I have also been a daily witness to similar cases occurring in tbe Mersey, where much damage has been done to the vessels; all of which I believe might be prevented, if a regulation were made under penalty, that (provided it could be done without risk of incurring greater danger by being drifted on shore or athwart hawse other vessels) the steamer on the larboard side should be compelled, when requested, to stop her engines and let the other go past.

4. *Burning.*—In the year 1817, I saw the *Prince Regent* Margate steam boat burnt off Reculver. This was owing to the wood work over the boilers, or round the chimney, not being properly cased with metal. All steamers built hereafter should be compelled by the Act to have a fixed space between the top of the boiler and the dock; or, where that could not be accomplished, to have the boiler-hatch covered with sheet iron instead of wood. Cases of spontaneous ignition of coal in the bunkers of steam vessels have been of frequent occurrence. The fine dust of coal, when highly dried and heated, is almost as liable to ignition by damp, as gunpowder is by fire. In one instance H. M. mail packet, *Vixen*, had the coals in a state of ignition for a considerable part of her voyage—Waterford river to Milford. The *Thetis*, Post Office steam packet, was burnt and sunk at her moorings in the Mersey, in October, 1833, owing to the same cause. The best remedy is to shovel the remaining coals forward in the bunkers, before taking a fresh supply, so that the coal is continually changed. This has always been done in her Majesty's mail packets at Liverpool since the burning of the *Thetis*, and there has been no subsequent case of spontaneous ignition.

5. *Sinking.*—Steam vessels are more liable to leak than other ships, owing to the number of pipes and bolts connected with the machinery, which are put entirely through the ship's bottom. As a precaution against sinking, therefore, I should recommend that all first class or river steam vessels be required to have at least one bilge pump worked by the engines, and at least one pump to be worked by hand on deck. These pumps may of course be made available for extinguishing fires. It might be a proper precaution, to require by the Act, that all steam vessels built hereafter, particularly iron vessels, should have a specified number of water-tight bulk-heads, dividing the vessel into compartments, as in the *Rainbow* iron steamer, and several others.

The author concludes with a list of steam vessels wrecked, sunk, burnt, or otherwise destroyed. We transcribe the latter part of the list from 1836 to 1839.

1836. *Rob Roy;* at the Nore, run down and sunk in a fog.

1837. *Albion.* Jack's sound; run on the rocks.

Sultan's Yacht. Dardanelles, ditto. 11 perished.

Apollo. Thames; run down by another steamer.

Victoria. Thames; explosion of boiler.

Don Juan. Straits of Gibraltar; wrecked in a fog.

1838. *Northern Yacht.* North Sea; foundered at sea; all perished.

Maid of Bute. Off Rothsay; burnt.

Andromeda. Bengall: unknown.

Farfarshire. Fern islands; wrecked on the rocks.

St. Patrick. Near Waterford; wrecked on the rocks in a fog.

Killarney. Coast of Ireland; water-logged and wrecked.

1839. *Tardert Castle.* Clyde; driven on the rocks.

SPINNING OF ROCK CRYSTAL.

At a meeting of the French Academy last week, M. Becqurel, in the name of M. Gaudin, presented some samples of threads spun from rock crystal, by means of fusion. Amongst the number, one measured three or four feet, and was wound into a skain, and another was so flexible, as to admit of its being wound round the finger. The tenacity and elasticity of these threads appeared very remarkable.

According to M. Gaudin, rock crystal becomes volatile at a temperature a little above its point of fusion; so much so, that a globule sometimes disappears in the space of a few seconds, preserving its spherical form to the last. Alumine is always perfectly fluid, or crystallized, and less volatile than silex; it may be reduced to

a viscous state; but viscosity disengaged from all tendency to crystalization, is the permanent state of silex under the influence of the oxygen blow-pipe. When rock crystal is once reduced to a state of fusion, it may be moulded with the greatest facility."

Threads spun from rock crystal, or even from common glass, possess the valuable property of being exempt from the influence of the ordinary causes of deterioration, and are less affected by variations of temperature than metals; but there is another substance, *amianthus* or *asbestus*, which in addition to the foregoing, possesses the valuable property of resisting the action of fire. The application of this mineral to useful purposes, is surprisingly neglected. The application to which we wish to call the attention of our ingenious readers, is the formation of a kind of paper that will effectually resist the action of fire, and present a surface fit for writing on; that being done, surely chemistry would furnish some unchangeable colouring matter for the ink, and then important documents and records might be secured from the destructive action of water and fire, and the slow, but fatal ravages of time.

Ciampini mentions four sorts of the asbetus stone: the first is long, and of a woody form, of a whitish colour, somewhat inclining to red; the second sort is of a silver colour, softer and shorter; the third, which is the worst of all, resembles scales or laminæ, one upon the other, like an onion, of a blackish earth colour, with some white, black, and dark red veins interspersed, and much shorter than either of the others: the fourth sort is longer than the others, but its filaments are thicker and rougher. He also says, that he heard of another sort, in *Montibus Volateranis:* and afterwards quoting some passages from Pliny, Dioscorides, and other authors who have mentioned this stone, and the cloth made from it, he touches upon its supposed use for the wicks of sepulchral lamps, and from some experiments, he concludes that it is unfit for that purpose, having always found the wicks made it go out. He affirms that he has kept it for three weeks in a glass-house fire, but he fouud it unaltered; from whence he concludes, that the amianthus looses nothing in the fire; but in handling, it wastes, though not much, as he found by an exact balance. Lastly, he proceeds to show the manner of spinning it, which he tried thus:—"First the stone is laid in water (the warmer the better), then it is opened and divided with the hands, that the earthy part may fall out, which are whitish like chalk, and hold the thready parts together; this makes the water thick and milky. This he repeated six or seven times with fresh water, where it is again opened and squeezed, till all the heterogeneous particles are washed out, and then the flax-like parts are collected, and laid in a sieve to dry; after which, lay the amianthus between two cards, such as wool is carded with; where let it be gently carded, and then clapped up between the cards, so that some of it may hang over the sides; then lay the cards fast upon a table or bench; take a small reel made with a little hook at the end, and a part to turn it by, so that it may be easily turned round; this reel is to be wound over with fine thread, and having a small vessel of oil ready, with which the fore-finger and thumb are constantly to be kept wet, both to preserve the skin from the corrosive quality of the stone, and render the filaments thereof more soft and pliant; thus by twisting the thread about upon the reel, with the asbestus hanging out of the cards, some of it will be worked up with it. By little and little, this thread may, with care, be woven into a coarse sort of cloth, and by putting it into the fire, the thread and oil will be burnt away, and the incombustible cloth will remain. But finding this way of uniting the stone with the thread very tedious, instead of the thread, he put some flax upon a distaff, and by taking three or four filaments of asbestus, and mixing them with the flax, he found they might be easily twisted together, and the thread thus made, was more durable and strong; so that there is no need of carding, which rather breaks the filaments than does any good, only after washing, open and separate the filaments upon a table, and take them up with the flax, which is sufficient. Of his four sorts of amianthus, Ciampini found that from Corsica (the first mentioned) the best, being long and soft, and the Cyprian sort the worst; though he doubts whether his was of the best sort, since the Cyprian is recommended by Pancirollus, and others he quotes. As to the making of paper, he says, in washing the stone, there will remain several short pieces at the bottom of the water, and, *of these, paper may be made after the common method.*" It is to this latter remark that we wish to direct the attention of our readers; for if any convenient method could be devised of producing indestructible writing, that discovery would doubtless be a source of considerable emolument to the inventor.

ADHESION OF NAILS.

EVERY carpenter is familiar with the use of the nail, and possesses a practical knowledge, more or less accurate, of the force of adhesion of different nails, and in different substances, so as to decide, without difficulty, what number, and of what length, may be sufficient to fasten together substances of various shapes, and subject to various strains. But, interesting as this subject unquestionably is, it has not been till very recently that the necessary experiments have been made to determine, 1st, the adhesive force of different nails when driven into wood of different species; 2nd, the actual weight, without impulse, necessary to force a nail a given depth; and 3rd, the force required to extract the nail when so driven. The obtaining this useful knowledge was reserved for Mr. B. Bevan, a gentleman well known in the mechanical and scientific world for the accuracy with which his experiments are conducted.

Mr. Bevan observes, that the theoretical investigation points out an equality of resistance to the entrance and extraction of a nail, supposing the thickness to be invariable; but as the general shape of nails is tapering towards the points, the resistance of entrance necessarily becomes greater than that of extraction; in some experiments he found the ratio to be about 6 to 5.

The following table exhibits the relative adhesion of nails of various kinds, when forced into dry Christiana deal, at right angles to the grain of the wood.

Description of Nails used.	Number to the lb. Avoirdupois.	Inches long.	Inches forced into the Wood.	Pounds requisite to extract.
Fine Sprigs . . .	4560	0·44	0·40	22
Ditto . . .	3200	0·53	0·40	37
Threepenny Brads . .	618	1·25	0·50	58
Cast-Iron Nails . .	380	1·00	0·50	72
Sixpenny Nails . . .	73	2·50	1·00	187
Ditto . . .	—	—	1·50	327
Ditto . . .	—	—	2·00	530
Fivepenny Nails . .	139	2·00	1·50	320

The percussive force required to drive the common sixpenny nail to the depth of one inch and half into dry Christiana deal, with a cast iron weight of 6·275lbs. was four blows or strokes falling freely the space of 12 inches; and the steady pressure to produce the same effect was 400lbs.

A sixpenny nail driven into dry elm, to the depth of one inch, across the grain, required a pressure of 357 pounds to extract it; and the same nail, driven endways, or longitudinally into the same wood, was extracted with a force of 257 pounds.

The same nail driven two inches, endways into dry Christiana deal, was drawn by a force of 257 pounds; and to draw out one inch, under like circumstances, took 87 pounds only. The relative adhesion, therefore, in the same wood, when driven transversely and longitudinally, is 100 to 78, or about 4 to 3 in dry elm; and 100 to 46, or about 2 to 1 in deal; and, in like circumstances, the relative adhesion to elm and deal is as 2 or 3 to 1.

The progressive depths of a sixpenny nail into dry Christiana deal, by simple pressure, were as follows :—

One quarter of an inch, a pressure of 24lbs.
Half an inch . . 76 „
One inch . . . 235 „
One inch and half . 400 „
Two inches . . . 610 „

In the above experiments great care was taken by Mr. Bevan to apply the weights steadily, and towards the conclusion of each experiment, the additions did not exceed 10lbs. at one time, with a moderate interval between, generally about one minute, sometimes ten or twenty minutes. In other species of wood, the requisite force to extract the nail was different. Thus, to extract a common sixpenny nail from a depth of one inch out of

Dry Oak, required . 507lbs.
Dry Beech . . . 667 „
Green Sycamore . . 312 „

From these experiments, we may infer that a common sixpenny nail, driven two inches into dry oak, would require a force of more than half a ton to extract it by a steady force.—*Adcock's Pocket Book.*

COMMON ROAD LOCOMOTION.

To the Editor of the Mechanic and Chemist.

Sir,—Will you allow me to inform Mr. T. Samuel Browne, that I did not intend to prove that there were more people employed by the railway than there were before by the various coaches, though I think at present there are. Neither are my arguments founded upon suppositions; for, if required, I can give good authorities to prove them to be facts.

"In 1830 rents in St. Albans were high, trade brisk, &c." How was it in 1837?

He has, I think, made some error with regard to the number of inhabitants of Redbourne, which I find, in 1831, to be 1784. And perhaps he would inform me of the fact, how many horses have been taken off the road to cause 180 hands in one village to be thrown out of employ. Will he also inform me how many houses were empty in St. Albans on the day of the opening of the Birmingham line?

It is well known that posting, on most roads (even where there are no railways) has of late years very much fallen off. I was told by the Boston coachman, that one town on his road had at one time constant work for 26 post-boys, and now not for more than seven or eight.

In conclusion, I beg to remark that my letter was not written to show the absurdity of common-road locomotion; neither has he yet proved, I think, that railroads are now, or ultimately will be, the cause of the working classes of this country starving.

C. H. S.

THE CHEMIST.

PHOTOGENIC DRAWING.

From the first communication of M. Daguerre to the French Academy, to the present time, we have given our readers the earliest information of each successive revelation relative to this magnificent and invaluable discovery; we have now the satisfaction of informing our readers that Messrs. Ackermann and Co., 96, Strand, have arranged an apparatus or photogenic drawing-box, which (by attending to the directions that accompany it) will enable any person to produce a picture *more true to nature than the performance of any human hand*, and that, too, in a very short space of time, varying with the intensity of the light, and also with the different methods of preparing the paper. Mr. Ackermann has favoured us with several specimens of pictures produced from the materials contained in his "photogenic apparatus;" one of them taken from lace, is so perfect, that it is unnecessary to give an imitation of it in an engraving. Lay a piece of lace, or any other object of a similar texture close upon a black surface, and it will present exactly the same appearance as the photogenic picture. This, though by no means the most important, or the most surprising application of the art, will nevertheless be found a great and valuable acquisition to all who have occasion to transfer a pattern from the original work to paper, not only on account of the absolute perfection of the design, but the very short time required to complete the operation. On this subject Mr. Ackermann truly observes, "The usefulness of its first application must be self-evident to all those who are aware of the tedious labour of drawing an intricate pattern correctly; by means of photogenic drawing, the most elaborate effort of the most skilful female hand, whether it has been directed to the production of the richest lace, or an elaborate piece of tambour work, can be copied in the space of *a few seconds*, without the least injury to the delicate fabric." To the botanist, the possession of this apparatus must henceforth be deemed as necessary as a mill in a Roman's household. Mr. Ackermann says, "The application of this art for the purpose of making botanical drawings, is likely to become an object of as much scientific importance to the botanist, as it must be of attraction to the amateur. The character of many portions of a plant, when preserved, even with the greatest care, in an herbarium, is always much altered from its original appearance in a state of nature. By means of the new art, the field botanist, if provided with a few sheets of photogenic paper and his drawing frame, may return home, after an hour's walk in the sun, with many highly finished botanical drawings, of the accuracy of which, no doubt can exist. To the entomologist, the new art offers a ready method of collecting in a small compass, and preserving for future inspection and comparison, correct figures and outlines of the wings, legs, and other parts of insects, on trifling distinctions in which their *specific*, and frequently even their *generic* character depends." The large wings are copied from a picture of butterfly's wings. One of them, it will be perceived, is an old spoiled wing; the small ones are taken from a drawing produced by etching upon glass (i. e., by covering the glass with an opaque varnish, and trac-

ing the figure with an etching point); by this method the light is allowed to pass through the transparent lines, and forms a corresponding image on the paper —an easy process. The process adopted by Mr. Ackermann, is that which was communicated by Mr. Talbot to the Royal Society; and though it may be inadequate to produce the splendid and perfect representations of distant objects as achieved by Daguerre; we are not prepared to say that it is not equally useful for purposes similar to those we have pointed out. In the name of that portion of the public with whom we hold communion, we congratulate Mr. Ackermann upon the success of his exertions, and the public upon the acquisition of an apparatus so long and so impatiently wished for.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, May 32, G. F. Richardson, Esq., of the British Museum, on the Geology of the South-east of England. Friday, May 24, Dr. Mitchell, on the History of Turkey. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, May 21, A. Morton, Esq., on the Science of Mechanics. At a quarter to nine.

Poplar Institution, East India Road. Tuesday, May 21, Mr. Cromwell, on the Ancient World. Friday, May 24, Discussion.

Islington and Pentonville Philo-Scientific Society, Prospect House, White-Lion-street. Thursday, May 23, M. C. Gascoigne, Esq., on Switzerland. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, May 20, Mr. Smith, and Mr. Thorne, Discussion—Which system, Competition, or Co-operation, is best calculated to promote Human Happiness. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, May 23, Southwood Smith, M. D., on Organization and Life. At half-past eight.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir, Can any of your correspondents inform me of a simple mechanical contrivance to keep the hand of a child in the proper position when beginning to learn to write? 2. What kind of an instrument is used by some of the teachers of the systematic writing, to fix on the hand of an adult who has got an inveterate habit of holding the pen wrong, and a very stiff hand, to compel them to hold it in a proper position? 3. What is the nature and details of the chirographist, or pen-directing machine of Mr. Perry, for which he received the medal of the Society of Arts and Commerce? 4. Where are Mr. Keyworth's transparent substitutes for slates in teaching writing (described "Slate's Partington's Cyclopædia"), and for which he was rewarded by the Society of Arts, to be purchased, and at what price? H. R. S.

Tonbridge.

Sir, Can you or any of your numerous correspondents inform me of a work containing the best method of keeping builders' accounts? H. Bull.

Sir, Your correspondent "C C." having favoured "R. S. L." with a solution to his question, I now beg the like favour for the following:—With what appearance do gold, silver, lead, and zinc, burn, while under the agency of a voltaic battery?

Strand. Erasmus.

Sir, Please to allow me to ask "C. C.", or any of your correspondents, for a description of the Silurus Electricus? Also, by whom was the identity of electricity and lightning discovered? R. S. L.

Sir, I wish to possess Dr. Beaumont's "Experiments on Digestion;" can you inform me where to purchase the cheapest edition? A Poor Man.

Sir, Can you or any of your correspondents inform me the best way to stain new oak to the colour of old oak, or to make old oak of a light brown colour? J. F.

Sir, I should feel much obliged to your very talented correspondent "Q. E. D." if he can inform me if the seams of balloons are inside or outside, and whether the balloon is lined with any materials. B. D.

Sir, Can any of your correspondents inform me the qualities of the respirator used by invalids? Also, how to make the magnetic oracle? Also, how to make a wet stone produce fire? W. M. B—r.

Sir, Can you or any of your numerous correspondents inform me of the process of making cloth water-proof? A Constant Reader.

ANSWERS TO QUERIES.

"Coles," No. 16. A good work on electro-magnetism is F. Watkins's Treatise on that subject. 2. A trough, in some cases, is most powerful, but its effects rapidly decrease; the pot battery continues in action for hours, and, I think, is far more useful for most purposes. 3. The greater the surface of copper opposed to the zinc, the more powerful are the effects produced. 4. A calorimetor is a kind of pot battery, whose plates (a single pair very often) are of very large dimension: it is used, as its name employs, for the excitement of intense heat. 5. The bladder is superseded by the porous tubes, as I distinctly stated in my query a few numbers back. A preserving pot would be totally useless as a substitute for the porous tubes, because they are not pervious to moisture, which is the very reason why the porous tubes are used; indeed in the common pot battery, the preserving jars are generally used to contain the voltaic combination. 7. The question respecting the mode of applying

the bladder to the zine I do not understand, not knowing either the battery or number to which he refers; but as I intend to continue my papers on electricity to galvanism, and perhaps electro-magnetism, he may find the information he requires in some of your future numbers. 8. He wishes to know of some scientific library near the bank; I think Herbert's, in Cheapside, would suit him. The terms I do not know, but we have a library of upwards of 6000 volumes at the London Mechanics' Institution, the subscription is 6*s*. per quarter, and 2*s*. 6*d*. entrance paid in advance; our next quarter commences the 5th of June, when, if he wishes to become a member, I will sign his admission (if he knows none of the members), by his calling at Mr. Towner's, No. 3, New Rutland-street, Sydney-square.

". R S. L." No. 18, may find directions for making phosphorus and chlorate (query, chloride?) of lime in any elementary work on chemistry; but he can purchase them cheaper than he can make them, at Dymond's, 146, Holborn Bars. Nitrate of strontian and nitrate of barytes are prepared by dissolving the carbonates of these earths, either the native or artificial, in nitric acid with heat, and crystallizing.

" F. E. L." No. 18. I have read the article mentioned by " Erasmus." in Partington's Cyclopædia, on making coloured fires; the red and green have already been given in your work, and the others mentioned in that article are of no use, except for vertical wheels, &c.; and many of them are dangerous, for I narrowly escaped blowing my hand up lately in trying them; they are far too fierce. I gave a recipe a few numbers back for some purple fire, but if " F. E. L.", or any of your correspondents, will send me a sample of better, to the direction stated above, I will endeavour to analyze it, and send you the result *pro bono publico*. Carburetted hydrogen cannot be easily deprived of the carbon it contains; but pure hydrogen may be economically obtained by passing steam through a tube filled with iron wire. ELECTRON.

SIR, In answer to " P. P." in your last, I believe from experience he will find " Optics," Parts 1 and 2, and " Optical Instruments," Parts 1 and 2, being Nos. 12, 13, 19, and 21, of the "Library of Useful Knowledge," price 6*d*. each; Baldwin and Co., London; the cheapest and best work published, particularly " Optical Instruments," Nos. 13 and 21; but both are very good.

SIR, In answer to one of your correspondents, I have found, putting a little common salt into ink prevent its moulding for some time.

H. R. S.

Tonbridge, May 11.

To prepare Nitrate of Silver.—" R. S. L." is informed, that nitrate of silver is prepared by adding to nitric acid, diluted with twice its bulk of pure water, pure silver, until the acid is saturated; the solution must now be evaporated, and then set aside to crystallize; these crystals, when pure, dissolve in their own weight of cold, and in half their weight of hot water, and do not deliquesce on exposure to air. Its solution is decomposed by exposure to light. Care must be taken that the water used for this purpose is perfectly pure; for in common water there is a deal of saline matter, which would throw down a quantity of the silver in the form of a chloride. Silver coin is sometimes used in place of pure silver, but I should by no means advise your correspondent to do so, as it is always alloyed with copper, which would make it unfit for the use of chemical analysis. Pure silver can be obtained of W. Newbery, chemist, 60, Fetter-lane, for eight shillings an ounce, and the nitrate of silver ready prepared for five shillings an ounce.

To make Gold Size.—In answer to the 7th query of ".J. S. E. L.", how to make gold size, it is made by boiling linseed oil, and while in this state protoxide of lead (common litharge) and acetate of lead (sugar of lead) in fine powder, are mixed with it. I do not know the proportions, but I should think about half an ounce of each to a pint of oil; by this it becomes very thick. It is then thinned to the proper consistence with spirits of turpentine. It ought to be made on some kind of stove, in the open air, as the sudden boiling over of the oil may occasion a serious accident. A. TAYLOR.

TO CORRESPONDENTS.

W. M. B. R—r. *Communications intended for prompt insertion, should be delivered a week before the date of publication; but previous arrangements, or subsequent occurrences, will sometimes cause an unavoidable delay.*

J. B. *wishes to know our authority for attributing the first conception of the art of printing to Cicero; if he will refer to cap.* 20, *lib. ii.* de natura deorum, *he will find a passage commencing* " Hic non mirer," *and ending* " tantum valere fortuna," *which will afford him ample satisfaction. It is there distinctly stated, that if numerous types of the different letters were made of " gold or what you please," they might be so combined as to form the whole works of a poet, and be worth a fortune to the possessor.*

R. H. L. *We are not in possession of the address of " W. C.", who offered to convey the desired information relative to galvanic apparatus to " R. H. L." We will insert the address of " R. H. L.", if he wishes it.*

P. S. O. *We have repeatedly stated, that the discovery of M. Daguerre is known only to himself and M. Arago. By referring to our article on the photogenic apparatus of Messrs. Ackermann and Co., our correspondent will perceive how much can be done by the processes at present known; when " the grand secret " is divulged, we shall not be the last to present it to the public.*

ERRATUM.—In page 143, col. 1, line 2, for " tube," read *table.*

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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PHOTOGENIC PRINTING.

City Press, 1, Long-lane, Aldersgate Street : D. A. Doudney.

PHOTOGENIC PRINTING.

The engraving in our front page, is a fac simile of a photogenic impression taken from an etching on glass. The process, as described by Mr. Ackermann, is as follows: To produce the appearance of a sepia drawing, cover the surface of the glass with a semi-transparent colour, say white lead, worked in mastic varnish. When dry, draw in all the outlines of the object with an etching point; this will remove the colour in the places it passes over: if now a piece of prepared paper be laid on to the drawing, and the glass placed in the frame, and exposed to the sun's light, the outline of the subject will appear, as if drawn with a pen upon a piece of tinted paper. The high lights are now to be painted on with an opaque colour, and gradually softened into the middle tints; which are represented by the semi-transparent ground: an impression now taken by the sun, will have all the appearance of a washed drawing in sepia or bistre, according to the colour assumed by the paper. To produce the appearance of a line engraving, cover the glass with a perfectly opaque colour, such as lamp black in varnish, and etch the subject with an etching point; every line can be printed by the sun's light, with the greatest distinctness, on the prepared paper. By either of these means, the likeness of a friend, or the view of some favourite spot, may, when once drawn on the glass, be multiplied to any extent.

The entomological specimens in our last, were all copied from designs taken from nature, and not partly from etching, as was stated by mistake.

PHOTOGENY.

M. de Gasparin has transmitted to the French Academy, a letter from M. Bonafons, of Turin, announcing the existence of a work which is rendered interesting and important, by the d scovery of M. Daguerre. It is in Italian, and printed at Rome in 1686: its title is, "*A Description of a New Method of Transferring all sorts of Designs upon Paper, by means of the Solar Rays.*" The name of the author is *Antonio Cel'io.* The report which we have received, does not describe the author's process.; but the mere conjecture of the possibility of producing pictures by the action of light, being entertained and published so long ago, and producing so little effect upon the philosophers of the day, is a circumstance which merits the profoundest consideration; and forms a striking example of the treasures which lie, scattered and neglected, among the exploded doctrines, and visionary theories of former days. It requires more laborious research than a promiscuous reader is disposed to afford, to collect the interesting passages from an accumulated mass of old writers; we shall, therefore, occasionally extract from old works, when we meet with matter which is likely to prove useful or interesting to our readers, without detriment to subjects of more general and immediate interest.

PRESSURE OF WATER AT GREAT DEPTHS.

Dr. Oliver relates, that in the bay of Biscay, in a hundred fathoms of water, a quart glass bottle, stopped with a large cork, and afterwards tied down with a strong packthread, was fastened to a rope, and, with a lead at the end, sunk to the bottom of the sea; upon drawing it up again, the cork was found quite pressed through the neck of the bottle into its cavity, and the bottle full of water. The experiment was repeated with another bottle and cork as before; but the cork not proving sound, the water soaked through it, and the bottle was half full of water: so the cork remained in the bottle, without being pressed down at all. The experiment was repeated a third time, in ninety fathoms of water, with a very sound cork, and much larger than the mouth of the bottle; for it was forced down with a hammer as far as it would go, leaving about an inch of the cork above the mouth of the bottle, and tied down as before: but it did not succeed so well as at first; though the cork was now pressed down into the neck, and became level with the mouth of the bottle.

At the depth of about thirty-seven feet, the pressure is increased one atmosphere; and at every succeeding descent, there is a corresponding increase of pressure: for, since it is evident, that the whole surface of the bottom must sustain the whole weight of the incumbent water, it follows, that any portion thereof must sustain the weight of the column which is perpendicularly incumbent upon that portion.

VIRTUES AND PROPERTIES OF SUGAR.

Dr. Slare relates, that his grandfather made it his daily practice to eat as much sugar as his butter spread upon bread would receive, for his constant breakfast,

unless he sometimes happened to exchange it for honey; he frequently sweetened his ale and beer with sugar; he had sugar put into all the sauces he used with his meat. At eighty years of age, he had all his teeth strong and firm; he never had any pain or soreness in his gums or teeth, and never refused the hardest crust. In his eighty-second year, one of his teeth dropped out, and soon after, a second, which was one of the fore-teeth; in short, all his teeth dropped out in two or three years, *and young ones filled up their room, and he had a new set quite round;* his hair, from a very white colour, became much darker; he continued in good health and strength, without any disease, and died in the 99th or 100th year of his age, of a *plethora*, as the Doctor conjectures, for want of bleeding. To prove the correctness of these remarkable facts, we have only the testimony of Dr. Slare, in a communication to the Royal Society, which was published in the Philosophical Transactions, No. 337. We leave it to our medical readers to consider, whether any connexion can reasonably be supposed to exist between the singular and enviable circumstances attending the latter years of this "fine old gentleman," and the peculiar nutriment which he received. Dr. Slare vindicates sugar from what he conceives to be an unjust character given to it by Dr. Willis, who charges it with a corrosive quality, as bad as aqua fortis, which he calls *aqua stygia*.

Sugar has been analysed by different modern chemists, but their results do not exactly agree. G. Lussac and Thenard have

Oxygen	50.63
Carbon	42.47
Hydrogen	6.90
	100.00

BERZELIUS.

Oxygen	49.856
Carbon	43.265
Hydrogen	6.879
	100.000

PROUT.

Oxygen	53.35
Carbon	39.99
Hydrogen	6.66
	100.00

URE.

Oxygen	50.33
Carbon	43.38
Hydrogen	6.29
	100.00

The mean of these four results is as follows:—

Oxygen	51.0415
Carbon	42.27625
Hydrogen	6.68225
	100.0

This last result is probably nearest the truth, and from the nature of its construction, necessarily nearer than *some* of the others.

RAILWAY TRAVELLING.

To persons who have been in the habit of travelling along the great English lines of railway, it is quite unnecessary to refute the assertion, that the convenience of the passengers is not attended to. The luxury of travelling, is a journey in the mail carriage from Liverpool to London. When we remember, like some dream of our childhood, the coach that used to spend twenty-four hours on the way—the jolts that every minute shook the aching bones of the passengers---rousing from the snatch of sleep (if sleep it could be called) that seemed almost to make longer the tedious hours of the night—the constantly recurring memento, "change coachman, sir," that assailed you at every stage—the door of the coach held open to admit the cold blast, while at the same time each passenger slowly unloosed his complicated muffling to reach the silver piece deposited in the inner fold of his voluminous vestments—when we remember all these as sufferings which once were to be endured, to accomplish the removal of our precious selves from Dublin to London; and when we find ourselves now wheeled along, just as much at our ease as if we were sitting here on our editorial throne, leaving Liverpool after a breakfast made more hearty by the slight heaving of the packet in the night, and reaching London in time for a dinner at a fashionable hour, with not enough fatigue even to sharpen the appetite,—we are almost led to believe that we have lived through centuries instead of years, or that some mighty magician has been upon the earth, and made the changes of years equal to those of centuries. Whenever we hear of any one complaining of the inconveniencies of railway travelling, we always wish that we had it in our power to sentence him for the rest of his days to travel by the common road.—*Dublin University Magazine.*

SILVERING.

We have frequently been applied to for a description of the different modes of silvering metals, &c. We extract the following from "The British Cyclopædia," but take the liberty of altering some parts, which are defective in the original:—

Copper may be silvered over by rubbing it with the following powder:—Two drachms of tartar, the same quantity of common salt, and half a drachm of alum, are mixed with fifteen or twenty grains of silver, precipitated from nitric acid by copper. The surface of the copper becomes white when rubbed with this powder, which may afterwards be brushed off and polished with a leather. A cheap silvering is prepared as follows:—Half an ounce of silver that has been precipitated from aquafortis by the addition of copper, common salt, and muriate of ammonia, of each two ounces, and one drachm of corrosive muriate of mercury, are triturated together, and made into a paste with water; with this, copper utensils of every kind that have been previously boiled with tartar and alum, are rubbed, after which they are made red hot and then polished. The intention of this process appears to be little more than to apply the silver in a state of minute division to the clean surface of the copper, and afterwards to fix it there by fusion; and accordingly, this silvering may be effected by using the argentine precipitate here mentioned, with borax or mercury, and causing it to adhere by fusion. The dial plates of clocks, the scales of barometers, and other similar articles, are silvered, by rubbing upon them a mixture of muriate of silver, sea salt, and tartar, and afterwards carefully washing off the saline matter with water. In this operation, the silver is precipitated from the muriatic acid, which unites with part of the coppery surface. It is not durable, unless protected with a coat of transparent varnish, which is applied in the manner of lacquor. The silvering of pins is effected by boiling them with mercury or tin, and tartar. Mirrors or globes are silvered by an amalgam consisting of one part by weight of bismuth, half a part of lead, the same quantity of pure tin, and two parts of mercury. The solid metals are first to be mixed together by fusion, and the mercury added when the mixture is almost cold. A very gentle heat is sufficient to fuse this amalgam. In this state it is poured into a clean glass globe, intended to be silvered, by means of a paper funnel, which reaches to the bottom. At a certain temperature it will stick to the glass, which, by a proper motion, may thus be silvered completely, and the superfluous amalgam poured out. The appearance of these toys is varied by using glass of different colours, such as yellow, blue, or green. To silver looking-glasses, the following articles are necessary:—First, a square marble table, or smooth stone well polished, and ground extremely true, with a frame round it, or a groove cut in its edges to keep the superfluous mercury from running off; secondly, leaden weights covered with cloth to keep them from scratching the glass, from one pound weight to twelve pounds each, according to the size of the glass laid down; thirdly, rolls of tin-foil; fourthly, mercury. The artist then proceeds as follows:—The tin-foil is cut a little larger than the glass, and laid flat upon the stone, and with a straight piece of hard wood, about three inches long, stroked every way, that there may be no wrinkles in it; a little mercury is then dropped upon it, and with a piece of cotton wool, or hare's foot, it is spread all over the foil; then the marble slab being kept nearly with the horizon, the mercury is poured all over the foil, which is covered with a fine paper; two weights are placed near its lower end, to keep the glass steady, while the artist draws the paper from between the silvered foil and the glass. This must be done with great care, so that no air bubbles be left. After the paper is drawn out, weights are placed upon the glass to press out the superfluous mercury, and make the foil adhere. Another method is, to slide the glass over the foil without the assistance of paper. To make shell silver, silver leaf is ground with gum water, or honey; the gum or honey is washed away, and the powder which remains is used with gum water, or white of egg, laid on with a hair pencil.

THE CHEMIST.

TESTS FOR THE DETECTION OF ANTIMONY.

To the Editor of the Mechanic and Chemist.

Sir,—An account of the poisonous nature of the salts of antimony, and the close analogy existing between the effects produced on arsenic and several other metals, by the tests for antimony, makes it a subject of great interest and nicety to prove its presence with satisfaction. Tartar emetic is the best salt of antimony for the use of testing, as it dissolves in water without decomposition. The solution is best when about half saturated; and care must be taken that the water is saturated with tartaric acid previous to dissolving the salt, in order to give complete solubility

to the oxide of antimony. The solution thus prepared, is ready for the following tests to be applied:—1st. Pure potass in solution throws down the oxide, but an excess of the alkali redissolves the precipitate; 2nd. Hydriodate of potass turns the solution of a bright amber colour, but causes no precipitate; 3rd. Acetate of lead throws down a dense white precipitate, which I consider to be an oxide of antimony. In my opinion a double decomposition takes place, both salts being decomposed in the following manner. The acetic acid of the acetate of lead combines with the potass of the tartar emetic, forming acetate of potass (tartar emetic is a compound of tartaric acid with oxide of antimony and potass, forming a double salt), while the tartaric acid combines with the oxide of lead, forming a tartrate of lead, forming two double salts, which of course remain in solution, while the insoluble oxide of antimony falls. My reason for thinking this to be connected is, that on testing the solution after filtration with bicromate of potass, a dense precipitate of cromate of lead fell; the usual effect produced by sulphuretted hydrogen on the salts of lead was also the case, but not the least trace of antimony could I find; but on dissolving the precipitate in water acidulated with hydrochloric acid, and on applying the tests for antimony, I had clear proof of its presence, while, on the contrary, it was quite free from lead. 4th. Tincture of galls causes a yellowish white precipitate. 5th. A stream of sulphuretted hydrogren passed through a solution of it, causes an orange-red precipitate, which is the hydrated sesquisulphuret of antimony. This is the only sure test for antimony; but there is one objection to this test, that is, it might be mistaken for sulphuret of arsenic (orpiment); but this may be obviated by passing hydrogen gas over the dried sulphuret, while heated in a glass tube: the sulphur combines with the hydrogen, forming sulphuretted hydrogen gas, while metallic antimony is left. I consider, that by treating the solution with acetate of lead, and dissolving the precipitate as before stated in the third test, and then passing a stream of sulphuretted hydrogen through the solution, the sulphuret is then thrown down, which needs no further examination, as arsenic is not precipitated by acetate of lead. Tincture of galls can never be relied on, as the salts of bismuth are precipitated by it in a very similar manner. Antimony is not precipitated by ammonia or ferrocyanate of potass. A. TAYLOR.

Important Chemical Dissovery.—One of the most valuable improvements in modern times has lately been achieved in the manufacture of soda from common salt, by the use of carbonate of ammonia instead of the pestiferous method hitherto employed in the production of that alkali. The inhabitants residing in the vicinity of the soda manufactories of Birmingham, Liverpool, Newcastle, Glasgow, &c., owe the inventors of this invaluable improvement a heavy debt of gratitude, as by this discovery they have put an end to the dreadful nuisance which the public have so long endured. The necessity of decomposing the chloride of sodium by sulphur no longer exists, the newly-discovered process being perfectly free from all noxious vapour. Another important advantage is also secured, namely, that the improved method can, with little additional outlay, be adopted to the manufactories at present in operation, and the workmen who have hitherto been frequently thrown out of employment and subject to the loss of their wages, in consequence of the numerous indictments that have been laid against their masters for nuisances, will no longer be subject to this evil. This process, when submitted to an eminent chemical lawyer for his opinion, was pronounced by him to be one of the most brilliant and ingenious discoveries in modern chemistry.—*Britannia.*

To make Green Fire under Water.—Put into a tumbler two ounces of water, and a piece or two of phosphorus about the size of a pea, then thirty or forty grains of chlorate of potash; then pour upon the mass, by means of a funnel with a long neck reaching to the bottom of the glass, five or six drachms of sulphuric acid. As soon as the acid comes in contact with the ingredients, flashes of fire begin to dart from under the surface of the fluid. When this takes place, drop into the mixture a few pieces of phosphuret of lime; this will immediately illumine the bottom of the vessel, and cause a stream of fire, of an emerald green colour, to pass through the fluid.

W. M. B—R.

To convert Paper into Frames for Pictures, &c.—For this purpose a convenient quantity of the best sort of white paper must be steeped for two or three days in water, till it becomes very soft; then, being reduced by the mortar and hot water into a thin pulp, it is to be laid upon a sieve to draw off its superfluous moisture; after which, it is to be put into warm water, wherein a considerable quantity of fresh glue, or common size, has been dis-

solved; it may then be placed in moulds to acquire the desired figure, and when taken out, may be strengthened as occasion requires with plaster, or moistened chalk, and when dry, painted or overlaid.

W. M. B—R.

Remarkable Illusion.—Fix, at the height of the eye, on a dark ground, a small round piece of white paper, and a little lower, at the distance of two feet to the right, fix up another, of about three inches in diameter; then place yourself opposite to the first piece of paper, and having shut the left eye, retire a few paces, keeping your eye still fixed on the first object; when you are at the distance of nine or ten feet, the second will entirely disappear from your right. W. M. B—R.

Machinery in India.—A Calcutta paper says, "We are glad to see that the increasing demand for machinery is likely to be supplied in the neighbourhood of Calcutta, without the necessity of waiting till orders sent to England can be executed. By an advertisement in our page, it will be seen that the Consipore foundry will undertake not only the ordinary work which has hitherto been executed, but also the manufacture of land and marine steam-engines not exceeding thirty-horse power, and also *iron steam-boats* from 100 to 500 tons. This is, indeed, a new era in the annals of Indian art, and will, we think, not a little surprise our friends in England, who imagine that we are dependent on them for every description of iron-work, down to a box nail. We wish the enterprising proprietor of the Consipore foundry the most complete success, as we look upon his undertaking as one of national importance, cheap machinery being, now almost a necessary of civilized life."—*Oriental Herald.*

Improvement in Steam Navigation.—On Wednesday week the first trial was made of the *Archimedes* steamer, propelled by a patent screw fixed in the dead wood of the vessel immediately in front of the rudder, but entirely under water, thus doing away at once with paddle-wheels, boxes, and their cumbrous apparatus. The *Archimedes* went ten miles per hour through the water, and thirteen miles an hour with the tide, but against the wind, and steered with the greatest exactness. She started again on Saturday afternoon, and went to Gravesend in one hour and forty minutes.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, May 29, G. F. Richardson, Esq., of the British Museum, on the Geology of the South-east of England. Friday, May 31, Dr. Mitchell, on the History of Turkey. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, May 28, A. Morton, Esq., on the Science of Mechanics. At a quarter to nine.

Poplar Institution, East India Road. Tuesday, May 28, Mr. Sanders, on Inebriating Liquors. Friday, May 31, Discussion, Elective Franchise.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, May 30, a Discussion. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, May 27, Mr. Claxton, on the Steam Engine. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, May 30, W. Ball, Esq., on the Comic Literature of the Kingdom. At half-past eight.

QUERIES.

To the Editor of the Mechanic and Chemist.

Sir,—Will you or any of your numerous correspondents inform me which is the best ink for steel pens, and the best method to make it? Also, how to make black and red ink powders? How to bronze plaster busts? W. M. B—R.

Sir,—Can any of your readers inform me how to make the best German paste for feeding birds?

John Nelson.

1. What kind of varnish is it that is laid upon steel pens to give them that beautiful brown? 2. How is it laid on? Can it be put on without fingering each separately? 3. Where can I find "Napier's Propositions?" T. (Sheffield).

How is the gold or silver leaf, and black, or any other colour applied to glass, so as to make it appear smooth, as it does round glasses in picture frames, &c? Also, how to mix the colour for the purpose? W. H. P.

How to clean white velvet, which is much soiled, without injuring the colours of some paintings thereon? A. B.

ANSWERS TO QUERIES.

To make Ivory Paper.—Take a quarter of a pound of clean parchment cuttings, and put them into a two-quart pan, with nearly as much water as it will hold; boil the mixture gently for four or five hours, adding water from time to time to supply the place of that driven off by evaporation; then carefully strain the liquor from the dregs through a cloth, and, when cold, it will form a strong jelly, which may be called size, No. 1; return the dregs of the preceding process into the

pan, fill it up with water, and again boil it as before for four or five hours; then strain off the liquor, and call it size No. 2; take three sheets of drawing-paper (outsides will answer the purpose perfectly well, and being much cheaper, are, therefore, to be preferred); wet them on both sides with a soft sponge dipped in water, and join them together with the size No. 2. While they are still wet, lay them on a table, and place upon them a smooth slab of writing slate, of a size somewhat smaller than the paper, and turn up the edges of the paper and glue them on the back of the slate, and then allow the paper to dry gradually. Wet, as before, three more sheets of the same kind of paper, and glue them on the others, one at a time, carefully removing all air-bubbles, by wiping from the centre outwardly. Cut off with a knife what projects beyond the edges of the slate; and when the whole has become perfectly dry, wrap a small flat piece of slate in coarse sand-paper, and with this rubber make the surface of the paper quite even and smooth; then glue on an inside sheet, previously wetted, which must be quite free from spots or dirt of any kind; cut off the projecting edges as before, and when dry, rub it with fine glass-paper, which will produce a perfectly smooth surface; now take half a pint of the size No. 1, melt it by a gentle heat, and stir into it three table spoonsful of fine plaster of Paris. When the mixture is completed, pour it out on the paper, and with a soft wet sponge, distribute it as evenly over the surface as possible, then allow the surface to dry slowly, and rub it again with fine glass-paper. Lastly, take a few spoonsful of the size No. 1, and mix with it three-fourths its quantity of water; unite the two by a gentle heat, and when the mass has cooled, so as to be in a semi-gelatinous state, pour about one-third of it on the surface of the paper, and spread it evenly with the wet sponge; when this has dried, pour on another portion in the same manner, and spr ad it; and afterwards the remainder, and diffuse it uniformly: when the whole has again become dry, rub it over lightly with fine glass-paper, and the process is completed. It may accordingly be cut away from the slab of slate, and is ready for use.—The quantity of ingredients above mentioned, is sufficient for a piece of paper $17\frac{1}{2}$ inches by $15\frac{1}{2}$. Plaster of Paris gives a perfectly white surface; oxide of zinc, mixed with plaster of Paris, in the proportion of four parts of the former to three of the latter, gives a tint very nearly resembling ivory; precipitated carbonate of barytes, gives a tint intermediate between the two. The objections to ivory are, its high price, the impossibility of obtaining plates exceeding very moderate dimensions, and the coarseness of grain in the larger of these; its liability when thin, to warp by changes of the weather, and its property of turning yellow by exposure to the light, owing to the oil which it contains. The superiority of ivory paper to ivory itself is, its not being liable for the colours to get injured, owing to the transudation of the animal oil; a defect which the ivory paper is free from.

Secondly. The possibility of obtaining superficial dimensions, much larger than the largest ivory, the colours being washed off the ivory paper more completely than from ivory itself; and the process may be repeated three or four times on the same surface, without rubbing up the grain of the paper. It will also, with proper care, bear to be scraped with the edge of a knife, without becoming rough. Traces made on the surface of this paper by a hard black-lead pencil, are much easier effaced by means of India-rubber, than from common drawing-paper.

Thirdly. It is superior to ivory itself, in the whiteness of its surface, in the facility with which it receives colour, and in the greater brilliancy of the colours when laid on. Owing to the superior whiteness of the ground, together with the extremely fine lines which its hard and even surface is capable of receiving, peculiarly adapts it for the reception of the most delicate kind of pencil drawings and outlines.

G. Nash.

Sir,—"J.R." Almore (No. 18), requires an account of the best and cheapest method of preparing blacking. I have selected the following from various sources, public and private:—

To make Blacking.—Take of ivory black, ground fine, 4 oz.; treacle, 4 oz.; vinegar, three quarters of a pint; sperm oil, 2 drachms. If the ingredients are of the best quality, this blacking will be found exceedingly good. Mix the oil and black first, then add the treacle, and lastly the vinegar.

Shining German Blacking.—Into an earthen vessel put any quantity of white wax, broke in small pieces, and add as much oil of turpentine as will cover it; in twenty-four hours the wax will be dissolved, when as much ivory black is to be mixed with it, as will give the mass a very black colour. This blacking does not require polishing, as, when it is used, a small quantity is put on the boot or shoe with a knife, and equally spread with a brush; the ethereal spirit of the oil then evaporates, leaving the wax on the boot and quite firm, black, and glossy. It needs no great sagacity to tell us there is one great objection to the above, viz., the smell of the oil of turpentine, which, though considered by many as healthy, is disliked by all as being disagreeable. I would, therefore, recommend the following:—

Blacking destitute of Unpleasant Smell.—Put into any convenient vessel a table spoonful of Florence oil; add by degrees a quarter of a pound of ivory black, beat them together with a spoon, until they are well mixed; then add a quarter of a pound of treacle in the same manner; afterwards add one pint of table beer (a little at first); mix them up well, and, lastly, add two ounces of oil of vitriol (sulphuric acid of commerce), stirring it up well all the time. This will be fit for use the next day, and will keep many years; if required to be what is termed paste blacking, the table beer must be lessened in quantity.

Ladies' Blacking.—Dissolve three ounces of best gum Arabic in one pint of good ink. This composition is applied with a piece of sponge; it dries in less than a minute without the application of a brush.

To make Aromatic Vinegar.—I beg to inform "A Lady" (No. 4), aromatic vinegar is composed of camphor dissolved in acetic acid (the radical of vinegar), and a few drops of an essential oil.

Erasmus.

Book-worm.—SIR,—Allow me to submit the following on the subject of my last letter, which I think is dated April 23, to prevent the ravages of the book-worm. At the time of inserting the above, I certainly did not give it a thought of the printing paper being thus impregnated with the poisonous quality of the corrosive sublimate finding its way into the possession of butchers and others, using it as an envelope for human food, and thus becoming injurious to the public at large, my attention being wholly engaged in the short space of time of indicting my letter of eradicating that pest to libraries, the book-worm and other winged insects; but since upon mature consideration I had seen the consequences that might result therefrom, I had resolved to address a few lines to you upon the subject in question; I now take this opportunity, and perfectly coincide in your opinion, of merely laying it on the surface of the paper when required, and of withdrawing my motion of the admixture of the corrosive sublimate, with the pulp of which paper is composed. G. NASH.

[Authors have so many, and such redoubtable enemies to contend against, that the puny attacks of the worms are not deemed worthy of attention, much less do they justify so extreme a measure as poisoning the paper. If our correspondent can suggest a means of protecting writers from critics, fools, and pirates; from the jealousy of the few, and the prejudice of the many, the dullness of many more, and the imperfections which are invisible only to the author himself, then shall his name be inscribed on the highest pinnacle of Parnassus.—ED.]

" H. Ball," No. 23. Perhaps " Laxton's Builder's Price Pook " will suit him; it is published at Weale's, 59, High Holborn.

" W. M. B—r." The respirator possesses the property of rendering the air inhaled by the wearer warm, however dense the fog surrounding him. This is effected by the air passing through many layers of particularly fine wire; and it is a singular fact, that the sound of the voice is as distinct with, as without the respirator. It is peculiarly beneficial to persons having delicate or otherwise injuriously affected lungs. A friend of mine has for many months used one, and received much benefit. PROPORTIO.

Remedy for Corns.—SIR, The following, though simple receipt for corns, I think will answer for your correspondent " Mentor," (No. 15); I have not known it fail in any instance:—Wrap the corn or corns round in a small bandage of new Welsh flannel for the space of a week or ten days, a cure frequently being performed in that space of time. It will probably irritate the corn or corns the first few days, and cause a little pain.

G. NASH.

TO CORRESPONDENTS.

W. H. E. *To make a transparent solution of shellac in alcohol, it is only necessary to procure* highly rectified spirit.

T. (Sheffield). *A hollow glass balloon, with a hole at the bottom, is made of such weight (by the introduction of a small quantity of water) that it will just rise when immersed in water. The glass vessel containing the water and balloon, or any other figure, is not entirely filled, a portion of air remaining between the surface of the water and the cover, which is a piece of bladder fixed air-tight on the top. When the cover is pressed down, the air within is compressed, and consequently exerts a greater pressure upon the surface of the water; this pressure is communicated in every direction, and to every particle of the water, forcing a portion into the balloon, and compressing the air contained within it, till its elastic force becomes equal to that of the air above. When the weight of the balloon is thus increased by the influx of water, it descends, being heavier than an equal bulk of water; when the pressure is removed, the water in the balloon is forced out again by the pressure of the air within, and it again ascends, and so it may be made to rise, fall, or remain suspended at any height at pleasure.*

J. Nelson *has some favourite birds which are tormented by small insects of a similar species, he thinks, to those nocturnal depredators who are of such ill report, that it is offensive even to mention their name. They disappear in the day time, and at night, they commit such ravages as soon destroy the birds. We should advise him in the first place to remove the birds into clean cages in the day-time, and clean the infested ones with boiling water, which is certain destruction to all animal life. We saw a contrivance some time ago, for destroying insects which secrete themselves in the joints and crevices of wood; a tin vessel containing water, and with only one small aperture by which the steam can escape, is placed over a fire till a strong current of steam is obtained; the steam is then directed to the parts where the insects or their eggs are lodged, causing the destruction of all those which are exposed to its action. Another method is that employed for destroying earwigs:—Squeese a sheet of paper into the form of a ball, so that there shall be many folds and openings into which the marauders will crawl in the morning, the trap being placed the evening before, near the plants on which they feed. The best way to dispose of the detestable tenants, is to lay the paper on a flat surface and step upon it; if the ground be uneven, many of them will have an opportunity of escaping. Whatever method our correspondent may adopt, we must caution him against employing any chemical process by strong odours, or otherwise, as that would be likely to injure the birds.*

A Correspondent *requests us to state, that a superior astronomical apparatus, peculiarly well adapted for public lectures, lies for inspection and sale at Mr. Child's, Vauxhall-walk, Lambeth.*

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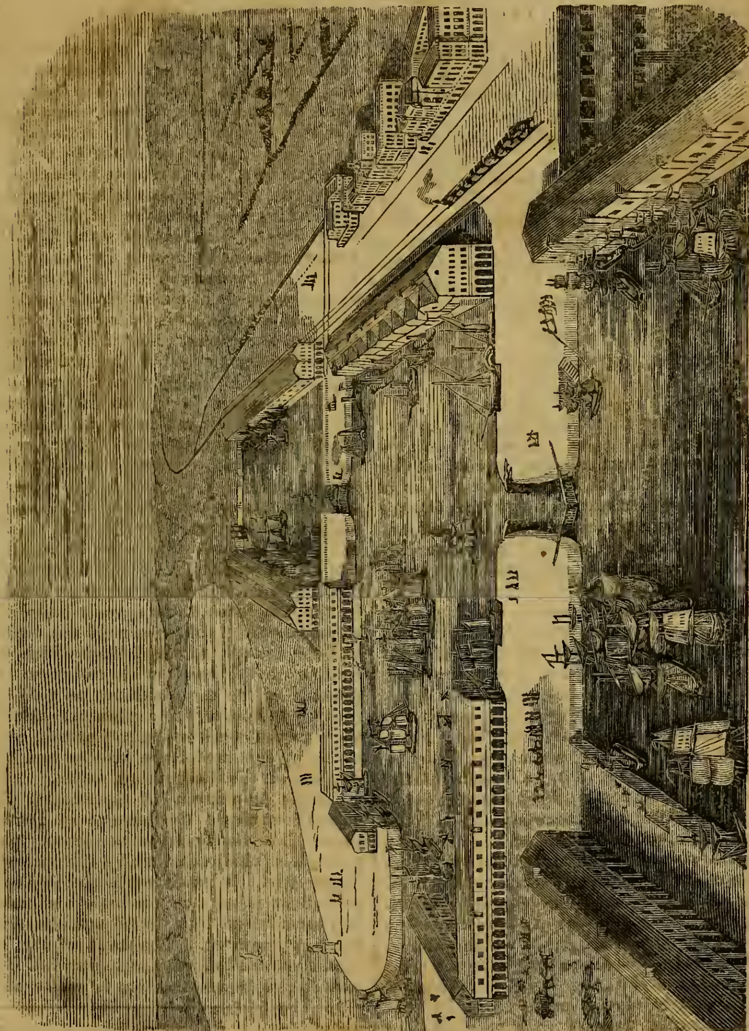
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXV. NEW SERIES. | SATURDAY, JUNE 1, 1839. PRICE ONE PENNY. | No. CXLVI. OLD SERIES.

THAMES HAVEN TIDE DOCK.



City Press, 1, Long-lane, Aldersgate Street; D. A. Doudney.

THAMES HAVEN TIDE DOCK.

(See engraving, front page.)

In July, 1836, a Company was incorporated by Act of Parliament under the denomination of "The Thames Haven Dock and Railway Company." But little progress has hitherto been made in the works, and it was feared by many, that the project was likely to be abandoned; they are, however, now proceeding, and it is anticipated that this great undertaking will be accomplished at no very distant period. In the front page is a bird's-eye view of the intended construction. It will occupy a space 1000 feet by 800. It is situated on the Essex side of the river Thames, about 36 miles from London. The Company have in view two great objects; first, accessibility under all circumstances of fluctuation of the tides, and second, to avoid the present winding and crowded navigation of the river. A branch from the Eastern Counties Railway is to lead from Rumford to the Dock. It is anticipated that the traffic on this railway will be very great in passengers, goods, and cattle.

HISTORY OF ARCHITECTURE.

NO. III.

We will now glance at the progress of architecture among the Grecians, whose remaining specimens are ample proofs of the paramount skill of the architects. It is most probable that, primarily, the Greeks derived their knowledge of this art from the Egpptians. The most antique architectural remains of Greece are rude, rough, gigantic walls. They are built without cement, and some, varying with their age, are more regular and even. The next step in advance is the tomb of Agamemnon, consisting of two excavated chambers, doubtless not unlike the Egyptian hypogea, though less rude, constructed of rough masses of rock laid more evenly than any of the walling above-mentioned. There is now a breach in the progress of this art, for we have no example bearing date between that of the tomb of Agamemnon and of the ruin of a regular columned, though massive, structure of the Doric order, situate at Corinth. The *precise* date of its erection is unknown. The columns are four diameters and a fraction in height, which proportion is altogether discordant with the after specimens of the Doric style. The crowning example of this order is the Parthenon, bearing date of four hundred and forty years before Christ. It has been styled "the most magnificent ruin in the world." The material of its construction is white marble. The columns are nearly six diameters in height. It is a fact much to be regretted, that there is no degree of certainty about the origin of the various orders. Vitruvius, the most ancient writer, and who, it would seem, should most be credited, stumbles sadly on this point. Of the Ionic, called also the Ionian style, there are several elegant specimens. The most so, are the temple on the Elyssus and the Erectheum. The former is of uncertain date, and though exceedingly plain, is, from its exquisite proportions and beautiful finish, a most wonderful piece of architecture. The latter is in date three hundred and ninety-three years before Christ, and consists of three adjoining temples, supposed to be dedicated to the goddess Minerva. It is replete with pleasing ornament, and the details are very fine. Concerning the invention of the Corinthian order, Vitruvius gives the following pretty account (whether correct or false, I cannot determine):—"A Corinthian virgin, who was of marriageable age, fell a victim to a violent disorder; after her interment. her nurse, collecting in a basket those articles to which she had shown a partiality when alive, carried them to her tomb, and placed a tile on the basket for the longer preservation of its contents. The basket was accidentally placed on the root of an acanthus plant, which, pressed by the weight, shot forth towards spring in stems of large foliage, and in the course of its growth reached the angles of the tile, and thus formed volutes at its extremities. Callimachus, who for his great ingenuity and taste in sculpture, was called by the Athenians κατατεχνος,* happening to pass by the tomb, observed the basket, and the delicacy of the foliage which surrounded it. Pleased with the form and novelty of the combination, he took the hint for inventing these columns, and used them in the country about Corinth, regulating by this model the manner and proportion of the Corinthian order." The Choragic monument of Lysicrates, frequently termed "the lantern of Demosthenes," is considered to be the only pure example of this order, and a splendid specimen it is. It consists of a circular colonade, sustaining a cupola highly adorned, and surmounted by a tripod and some rich foliage ornament. The caps of the columns are most elegant and graceful. The material of its construction is white mar-

* Greek term, signifying artificial, wrought by art.

ble, and its date is three hundred and thirty five years before Christ.

In Greece, architecture was cultivated to an amazing extent with the most unparalleled success, and the existing remains speak loudly of the fine perception and exquisite taste of the Grecian people.

PROPORTIO.

NAVIGATION.

CAPTAIN LETOURNEUR has communicated to the French Academy, the result of experiments which he has undertaken with a view of determining the direction of a ship's course with respect to the wind, to produce the greatest speed with ships of three masts. Ships are constructed so that they may move in the direction of the keel or great axis of the vessel, with the least possible resistance, the greatest effective force, and consequently the greatest velocity of the ship will therefore be obtained when it moves in that direction with the wind behind, also moving in the same line. If the sails, instead of being in a single vertical plane, are in several planes, moveable about separate axes, the problem assumes a different character, and becomes susceptible of very different solutions. Let there be a ship with three vertical masts, which, from the back to the front, are the mizen, main, and fore-mast. When the wind blows from behind, the sails of the foremast are entirely masked by those of the main-mast, which are also partly masked by those of the mizen mast; so that the ship receives only a portion of the impulsive force which it would receive if the wind arrived without impediment upon each vertical sail. But let the ship be inclined to the wind, the sails will become unmasked, more and more, and will receive a greater impulse from the wind, in proportion as the direction of the ship's keel varies with that of the wind. In this case there will be two contrary effects; first, on account of the obliquity of the ship's path, the action of the wind on each sail will be less effective in producing progressive motion; and, secondly, the impulsive forces will be multiplied by the gradual unmasking of the sails. In first-rate ships of war, the keel should be inclined at an angle of more than 45 degrees with the wind, in order to unmask the sails entirely, especially when they are not perpendicular to the direction of the wind.

M. Letourneur, in the course of his experiments, has measused the velocity by the log, repeating the observation without intermission. He thus obtained an average speed, which did not differ from the least speed observed, more than 0.04.

The definitive result at which the author arrives is, that the speed of a vessel estimated according to the direction of the wind, is at its maximum when the keel forms with the direction of the wind an angle of 28° 7′ 3″, or of 32° 30′.

The committee appointed to report upon this communication, regrets that the experiments were not more multiplied; they propose that they should be repeated from 0° to 90°, increasing the angle by 5° at each experiment; the effect should be observed with winds of different intensity, and with two ships of equal dimensions, constructed, armed, and rigged upon the same plan; sailing, the one without changing its direction or its sails, and the other varying these two conditions. Finally, it is proposed, that in another series of experiments, the mizen-mast should be suppressed, and afterwards the mizen and main masts simultaneously.

PERPETUAL MOTION.

PERPETUAL motion can scarcely be considered as a subject for discussion, since all reason is on one side, and all error on the other; it does not depend upon opinion, but upon the possession or want of mechanical knowledge. It is an unfortunate trait in those who are afflicted with the mania of perpetual motion, that they invariably conceal their operations with the utmost jealousy, fancying that the admonitions of reason, the remonstrances of science, and the solicitude of friendship, are all cunning plots to bereave them of their cherished secret. The ravages of this hallucination have considerably decreased since the commencement of the present century; the number of persons constantly or partially employed in this singular pursuit forty years ago, would appear incredible to those who have not had the opportunity of making extensive inquiries, not only of mechanics, but of men whose superior education ought to have taught them more wisdom. At the present day, though the number is considerably diminished, there are many persons, men of talent, too, who are sacrificing their time and their money in this very unprofitable and utterly useless occupation. The numerous communications we are continually receiving on the subject, is a sufficient proof that it still remains a theme of visionary speculation, and weights, springs, wheels, screws, and levers, are still sacrificed upon its altars. The following may be taken as a fair specimen of this kind of production.

A wheel was formerly exhibited at Hesse Cassel, made by M. Orfireus, and called by him "perpetual motion;" Dr. Desaguliers proved that the principle was false, and by no means adequate to produce a perpetual motion. Persons engaged in this delusive pursuit, take it for granted, that if a weight, descending in a wheel, at a determinate distance from the centre, does in its ascent approach nearer to it, such a weight in its descent will always preponderate and cause an equal weight to rise, provided it comes nearer to the centre in its ascent; and, accordingly, as it rises, it will be overbalanced by another equal weight on the opposite side of the wheel, removed farther from the centre, and therefore possessing the mechanical advantage of a longer lever. The Doctor shows that perpetual motion-makers mistake one particular case of a general theorem, or rather a corollary of it, for the theorem itself, which is as follows:—

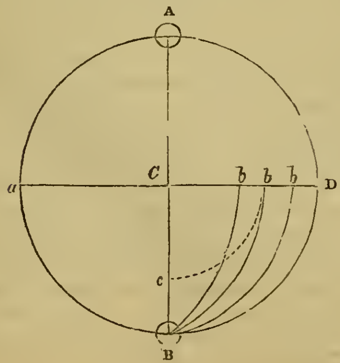
Theor.—If one weight in its descent does, by means of any contrivance, cause another weight to ascend with less momentum or quantity of motion than itself, it will preponderate and raise the other weight.

Cor. 1.—Therefore if weights be equal, the descending weight must have more velocity than the ascending, because the momentum is made up of the weight, multiplied into the quantity of matter.

Cor. 2.—Therefore, if a lever or balance have equal weights fastened or suspended at its ends, and the *brachia* (or arms) be ever so little unequal, that weight will preponderate which is farthest from the centre.

Scholium. This second corrollary causes the mistake; because those who think the

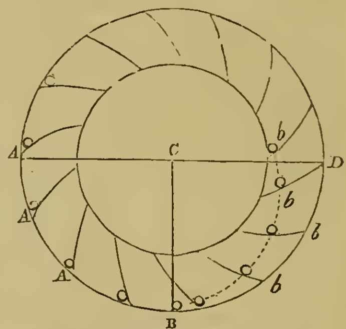
Fig. 1.



velocity of the weight is the line it describes, expect that that weight shall be overpoised, which describes the shortest line, and therefore contrive machines that cause the ascending weight to describe a shorter line than the descending weight does. For example, in the circle A D B, the weights A and B, being supposed equal, they imagine that if (by any contrivance whatever) while the weight A describes the arch A *a*, the weight B is carried in any arch, as B *b*; so as to approach nearer the centre in its rising than if it went up the arch B D, the weight shall be overpoised; and consequently, by a number of such weights, a perpetual motion will be produced.

This is attempted by several contrivances, which all depend upon this false principle. Dr. Desaguliers only mentions one, where a wheel with two parallel circumferences, has the spaces between them divided into cells; in each of which is inserted a spherical weight, moving freely from one circumference to the other.

Fig. 2.



When the wheel goes round, these weights will descend on the side, A A A, at the outward circumference; and on the side D, they will ascend in the line B *b b b*, which approaches nearer the centre, and touches the inner circumference of the wheel. The weights, it is true, will move in that manner if the wheel be turned round, but will never be the cause of the wheel's going round. A machine of this kind is mentioned by the Marquis of Worcester in his century of inventions, No. 56, in the following words:—

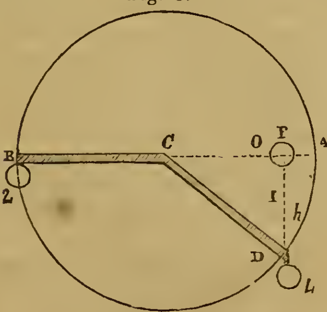
"To provide and make that all the weights of the descending side of a wheel shall be perpetually farther from the centre than those of the mounting side; and yet equal in number and heft to the one side as well as the other; a most incredible thing if not seen; but tried before the late king (of blessed memory) in the Tower, by my directions, two extraordinary ambassadors accompanying his ma-

F C Twyford

jesty, and the Duke of Richmond and Duke of Hamilton, with most of the court attending him. The wheel was 14 foot over, and had 40 weights of 50 pounds a piece. Sir William Balfore, then lieutenant of the Tower, can justify it, with several others. They all saw, that no sooner these great weights passed the diameter line of the lower side, but they hung a foot further from the centre; nor no sooner passed the diameter line of the lower side, but they hung a foot nearer. Be pleased to judge tbe consequence."

Now the consequence anticipated from this and all similar machines, is nothing less than perpetual motion, which is impossible; the fallacy is this. The effective velocity of any weight is not the line which it describes in general, but the height which it rises up to, or falls from, with respect to the centre of the earth; so that when the weight in fig. 1 describes the arch A *a*, its velocity is the line A C, which shows the perpendicular descent (or measures how much it comes nearer the centre of the earth), and also the line B C, denotes the velocity of the weight B, or the height that it rises to when it ascends in any of the arches B *b*, instead of the arch B D; so that in this case, whether the weight B, in its ascent be brought nearer the centre or not, it looses no velocity, which it should do, in order to be raised up by the weight A. In some cases, the weight in rising nearer the centre of a wheel, may not only preserve its velocity, but be made to gain velocity in proportion to its counterpoising weight that descends in the circumference of the opposite side of the wheel; for if we consider two radii of the wheel as represented by fig. 3, one of which is horizontal, and the other (fastened to, and moving with it) inclined under the horizon in an angle of 60 degrees, and by the descent of the

Fig. 3.



end, B, of the radius B C, the radius C D, by its motion, causes the weight at D to rise up the line *p* P, which is in a plane that prevents the weight from rising up the curve D A, that weight will gain velocity at the beginning of its rise, and have twice the velocity of the weight at B; and, consequently, instead of being raised, will overpoise, if it be equal to the last mentioned weight; and this velocity will be so much the greater in proportion as the angle A C D is greater, or as the plane P *p* (along which the weight D must rise) is nearer to the centre. It is true that if the weight at B, fig. 1, could by any means be lifted up to C, the end would be answered, because the velocity would then be diminished, and become *c* C.

Experiment. Take the lever B C D (as in fig. 3), whose arms are equal in length, inclined in an angle of 120 degrees at C, and moveable about that point at its centre; in this case a weight of two pounds, suspended at the end B, of the horizontal part of the lever, will keep *in æquilibrio*, or balance, a weight of four pounds, suspended at the end D; so that in the motion of D, along the arch *p* A, this weight is made to rise up against the plane P *p* (which equally divides the line A C equal to C B), it will keep *in æquilibrio* two pounds at B, as having twice its velocity when the lever begins to move. This will be evident if you let the weight 4 hang at D, while the weight 1 lies above it; for if you then move the lever, the weight 1 will rise four times as fast as the weight 4. The misunderstanding of this principle has misled so many perpetual-motion seekers, that there are probably very few who will not recognize it as their own invention, or at least as very nearly resembling it. The attainment of perpetual motion by mechanical means, is not difficult, but absolutely impossible. We do not offer this as an opinion, but as a known and established fact, acknowledged by all who are acquainted with the immutable laws of motion, and the true principles of mechanics.

RAILWAY FIRES.

To the Editor of the Mechanic and Chemist.

SIR,—Allow me just to call your attention to the following paragraph extracted from the *Reading Mercury*:—

" *Railway Fires.*—Shortly after five o'clock on Tuesday afternoon, a bean rick standing near the Great Western Railroad at Salthill, was fired by the sparks of the steamer conveying the five o'clock train, and entirely consumed: it was the property of Mr. Alrige, of Chippenhorn. About a quarter before eight in the even-

ing of the same day, a range of sheds belonging to the company at Horsemour-green, about two miles higher up the line was fired in the same manner, and the principle portion of them destroyed; and the same evening the coke sheds belonging to the company, at Maidenhead, were partly consumed, having taken fire from some coke that was thrown into them in a burning state."

These are occurrences which ought not to transpire, because so readily obviated. Were the mouths of the chimneys screened with wire gauze (which I feel assured is not at present the case) in a similar manner to the river steamers, the possibility of such accidents as the above would be removed. I remain, Sir, yours, &c.

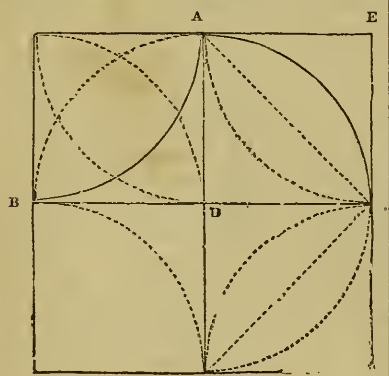
PROPORTIO.

ANSWER TO PROBLEM.

To the Editor of the Mechanic and Chemist.

SIR,—I beg to send the enclosed as an answer to the problem of "A. Z.", in No. 15:—

From centre, E, with radius, E C, sweep A C, and will it not bisect A B C, A.



C.H.S.

Bishopsgate, May 15.

THE CHEMIST.

ELECTRICITY.

NO. IV.

(Continued from page 143.)

I HAVE now sufficiently developed the Franklinian theory, to apply it to the action of the electrical machine. Glass is a substance which has a greater attraction for the electric fluid than almost any other body we are acquainted with; consequently, when the cylinder of the machine (which is formed of it), by causing it to revolve, is rubbed against the cushion, which has a much weaker attractive power, it abstracts a portion of electricity from it, which is immediately attracted by the points attached to the conductor (the silk flap defending it from dispersion into the air until it arrives there.) The cylinder then acquires a second charge from the rubber, which is disposed of as before, and thus the action continues as long as the cylinder continues its revolution. But it is evident that the rubber must soon become exhausted if no means is employed to renew its charge: for this purpose a chain is attached to it, leading to the ground, which may be regarded as the grand reservoir of the electric fluid; by this means we may continue the action of the machine as long as we please. When the Leyden jar is attached, by its knob, to the conductor, a current of electric sparks flows from the conductor to it; and a corresponding current flows from the outside, through any conducting substance, to the earth, as I before stated. By this means a jar may be charged by its own natural electricity, by applying its knob, as usual, to the conductor, and carrying a chain from the outside to the rubber: the electricity is thus transferred, in the manner explained above, from the outside to the inside of the jar; the explosion, when it is discharged, being caused by the rapid passage of the electricity in restoring the equilibrium. Having thus given a concise explanation of the Franklinian theory of electricity, I shall now proceed to treat of its effects; and having, in Experiments 5 & 6, noticed some of its luminous properties, I shall proceed with others of a similar nature.

7. Take the balls off the wires of the universal discharger (a cheap form of which I described about 14 months since in your miscellany) and then insert the wires into an onion, so as to be about half an inch apart; pass a charge from a moderate sized jar through it, and it will appear beautifully illuminated.

8. Instead of the onion substitute an apple,—the same effect takes place.

9. Place a piece of loaf sugar on the table of the discharger, and set the wires as before under the sugar; it then, on passing the charge, appears highly luminous.

10. Lay a block of dry wood in the place of the sugar, cut a groove in it sufficient to let the wires lay easy just below its surface, distance as before; put the finger or thumb over the interval, and on passing

the charge it appears quite translucent. Similar effects take place by substituting nearly any opaque substance for those I have mentioned, provided they are but imperfect conductors of the electric fluid; many minerals giving various colours, which I believe are the same as those they produce when made phosphorescent by heat. It may be as well to mention that the effect it but momentary in nearly every case. It is evident that the distance at which the wires are placed must depend on the size and power of the jar; I use one of thin glass, which will hold nearly two quarts of water.

Before leaving this part of my subject, I must notice another experiment, illustrative of the truth of the Franklinian theory. I shall probably often do this when opportunity offers.

11. Insert a pointed wire into the *positive* conductor, then turn the machine, and a *brush* of light appears to issue from it, which seems to indicate that something was passing from it; hold another pointed wire a short distance from it, a *star* of light appears at its end as though the fluid was entering it.

12. Reverse this experiment, by putting the wire into the rubber, or *negative* conductor; it there appears as a *star*, and the wire applied to it assumes the *brush* appearance, thus affording another confirmation of the views of the immortal philosopher I have just named.

The next division of the effects of electricity, as exhibited by our ordinary apparatus, that I shall treat of is its mechanical phenomena, and the first of these affords a fine illustration of the truth of the theory of Franklin.

13. Remove the table from the universal discharger, and in its place insert a glass pillar, mounted with a delicate wheel, similar to the breast wheel in hydraulics; the vanes should be rather long, and the whole made as light as possible. Fix the pointed wires of the discharger as near the wheel as you can, without causing its revolution to be impeded, the points being parallel to each other, and just below the upper edge of the wheel; then connect the conductor, by means of a chain, with one of the wires of the apparatus, and let the other be connected with the ground or the other conductor of the machine; when this is excited, a luminous current of electricity flows, as before described, from positive to negative, and the wheel begins to revolve in the same direction. By placing the same air in connexion with the opposite conductor, or connecting the opposite wire in the same conductor, the revolution takes place in the opposite direction. This experiment clearly demonstrates, in my opinion, the passage of a *material* fluid from the positive to the negative wire of this apparatus, as well as confirms the theory of the existence of but one fluid; for if there were two, according to the opinions of Dufay, whose uniting together should restore the electrical equilibrium, the wheel, in the experiment just mentioned, should remain stationary, owing to the flow of electric matter from both wires, towards the wheel, in opposite directions, causing the action and re-action to be equal. And if electricity was not a material substance it could not produce motion in the wheel.

ELECTRON.

Montgolfier Balloon.—A correspondent inform us, that a Montgolfier balloon, upon an extensive scale, has again been manufactured, and that an experimental voyage was recently made from the Beulah Spa with greater success. Five persons ascended, one of whom, by some means or other, got his leg entangled in the ropes which held the balloon, and sustained a fracture of the limb just above the ancle joint.

London and Birmingham Railway.—On the 20th of next month the speed of the mail trains on the London aud Birmingham Railway will be accelerated. The day mail will leave the Euston-grove station at half-past nine in the morning, and will arrive at Birmingham in five hours. A stoppage of eight minutes will be allowed at Tring, ten minutes at Wolverhampton, three minutes at Weedon, and nine minutes at Coventry; making a total of twenty-five minutes occupied by the stoppages, and only four hours and thirty-five minutes in performing the journey of 116 miles six furlongs. The day mail train from Birmingham will accomplish the journey in the same time, allowing the same stoppages at the different places above mentioned. The night mail train will leave Euston-grove station at half-past eight, and complete the distance in five hours and a half; the stoppages to be for the same periods and at the same places as those named for the day mail trains.—*Patriot.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, June 4, W. Jones, Esq., on Animal Mechanics. At a quarter to nine.

Poplar Institution, East India Road. Tuesday, June 4, Mr. Bowkett, on Philosophy of Health. Friday, June 7, Discussion, Living Poets.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday,

June 6, John Dyer, Esq., on Carbon, and its Compounds with Oxygen. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, June 3, Mr. H. Clarke, on the Theory of Colours. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, June 6, George Foggo, Esq., on the Fine Arts. At half-past eight.

QUERIES.

What is used in the dressing of Irish linens to render them smooth and glossy, or whether there is any other material used than starch in the getting up of linens, by which the gloss can be obtained? F. H. G.

What is the most economical way to remove fat and grease from bladders (without injuring them), so that a solution, composed principally of spirits and water may be applied to the surface of the bladders? J. A.

How is the gold ink made which may be used with a pen like common ink? Also, how can I melt glass so as to make seals? E. J. S.

How to make a good black dye for cotton and silk? Also a good claret dye for ditto? How to make fine black paint (a small quantity, say a quarter of a pound? Also how to make white paint? R. K.

A simple method to make tarpauling? I have some very thick canvass; paint I find will be very expensive. A Vender.

The best method of making a dye to change the colour of the human hair either black or brown?
Pratt-st., Camden-town. H. S.

ANSWERS TO QUERIES.

Sympathetic Inks.—" W. M. B—r."—A diluted solution of muriate or nitrate of cobalt will, on being held to the fire, appear of a blue colour; should the cobalt be adulterated with iron, the writing will appear of a green colour; when cold it will entirely disappear. Also, a diluted solution of muriate of copper being applied on paper will be invisible when cold, but when heated, will appear of a yellow colour.

" H. R. S.", Tonbridge. A very simple instrument, called the " Aidegraph," for that purpose, may be obtained, price 2s. 6d., at a small shop on the Surrey side of Waterloo bridge.

To make a Wet Stone produce Fire.—" W M. B—r." Take of quick lime, saltpetre, tutia-Alexandrina, and calamine, of each equal parts; live sulphur and camphor, of each two parts; beat and sift them in a sieve, then put them in two crucibles, mouth to mouth, lute them well together; then put the crucible in a potter's furnace; when cold, the powder will be altered to the substance of a stone that will, when wetted, produce flame, which may be blown out at pleasure.
Camberwell. W. S. G.

Sir,—I beg to inform your correspondent " Erasmus," that gold, under the agency of a Voltaic battery, burns with a white flame. tinged with blue; silver, emerald green; lead, purple; zinc, with a blueish light fringed with red; and copper, a blueish light, with sparks.
Lambeth. F. Rowed.

Sir,—I shall feel obliged if your correspondent, who inserted the query in No. 23, (N. S-), under the name of " Erasmus," (to " C. C.) will favour me with a call, or send me a few lines, (directed to " Erasmus." No. 33, Strand), stating where and at what time it would be most convenient for me to see him, as I wish to give him a little friendly advice, and at the same time will answer his question.
Erasmus.

TO CORRESPONDENTS.

X. Y. Z. *The shell gold is prepared from gold leaf by a similar process to that described in No 24 for silver. The gum or honey will certainly dissolve in clean hot water, and leave the powder bright and clean.*

A Young Beginner. *The reason that water, when boiled under the exhausted receiver of an air-pump is first converted into steam at the lower part of the vessel, must be, that the vessel is more heated at that part. If boiling water be poured into a glass globe, and placed under an exhausted receiver, bubbles will no doubt be formed promiscuously in all parts. The only effect of removing the pressure of the air is, that ebullition will take place at a lower temperature. Dark colours conduct heat more freely than light ones. Take two similar thermometer tubes, and cover the bulb of one with white thread, and the other with similar thread dyed black; immerse them both in hot water till they indicate the same temperature; it will be found that the black one will rise sooner than the white one, and when they are taken out, the black one will descend sooner than the white.*

A Subscriber (Regent's Park). *When charcoal is heated to a certain degree,* carbonic acid gas *is evolved. It may also be obtained by exposing lime stone, marble, or chalk, to a strong heat, when it assumes the elastic form, and may be collected,*

G. M. F. *shall be attended to.*

T. B. P.—*We will endeavour to obtain correct information upon the subject of his inquiry in time for our next.*

Proportio.—*In thanking our correspondent for his drawings of Egyptian architecture, we avail ourselves of the opportunity of complimenting him on the beautiful accuracy which distinguishes all his drawings.*

The North Star.—*The articles he speaks of are in preparation, and will shortly appear. We thank him for his offer, but we are already in possession of the necessary information on the subject to which he alludes.*

London: Printed at " The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

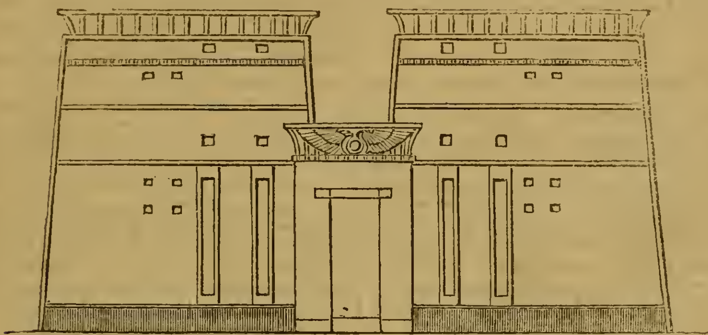
THE

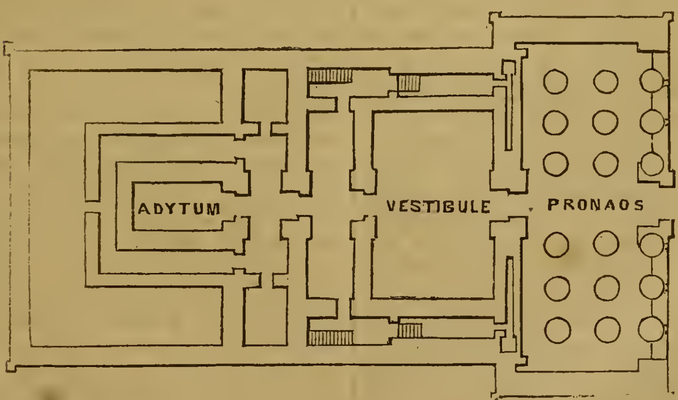
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. XXVI. & XXVII. NEW SERIES.	SATURDAY, JUNE 8, 1839. (PRICE TWO PENCE.)	Nos. CXLVII. & CXLVIII. OLD SERIES.

EGYPTIAN ARCHITECTURE.





City Press, 1, Long-lane, Aldersgate Street: D. A. Doudney.

EGYPTIAN ARCHITECTURE.

The engravings in our front page, representing the plan and elevation of the Temple of Apollonopolis, are from drawings by our correspondent, "Proportio," and described in a preceding number. The façade of the building is represented as it formerly was, judging from the remains and from descriptions. The excellence of ancient architecture, unrivalled by succeeding ages, renders the study of Roman, Grecian, and even Egyptian models, essential to the attainment of good taste and judgment; but we refrain from enlarging on this prolific subject, leaving it to our correspondent, who will, no doubt, favour us with a continuation of his interesting articles.

THE CENTURY OF INVENTIONS

BY THE MARQUIS OF WORCESTER, 1655.

The extraordinary propositions of this original genius have at all periods since their first publication, excited great interest and curiosity. Although the author states that he has *tried and perfected them*, it is certain that he has not put them in practice; for although several of his projects which have been stigmatized as extravagant and absurd, have since been realized, there are others which are entirely beyond the pale of possibility; but so many things which he has only vaguely hinted, have since been accomplished, that even those which still present the appearance of impossibility, should not be rejected without careful consideration and study; and, in his own words, "it is a poor dog not worth whistling after." We give them *verbatim* from the original.

1. "Several sorts of seals, some showing by screws, others by gauges, fastening or unfastening all the marks at once; others by additional points and imaginary places, proportional to ordinary escocheons and seals at arms, and each way palpably and punctually setting down (yet private from all others but the owner, and by his assent) the day of the month, the day of the week, the month of the year, the year of our Lord, the names of the witnesses, and the individual place where anything was sealed, though in ten thousand several places, together with the very number of lines contained in a contract, whereby falsification may be discovered, and manifestly proved, being upon good grounds suspected.

Upon any of these seals, a man may keep accounts of receipts and disbursements, from one farthing to an hundred millions, punctually showing each pound, shilling, penny, or farthing.

By these seals, likewise, any letter, though but written in English, may be read in eight several languages, and in English itself, to clear, contrary, and different sense, unknown to any but the correspondent, and not to be read or understood by him neither, if opened before it arrive unto him, so that neither threats nor hopes of reward can make him reveal the secret, the letter having been intercepted, and first opened by the enemy."

This does not impart much information, nor is it likely that such results will ever be obtained; but the suggestion in the last paragraph, that a secret signal should be rendered unintelligible by opening the letter, is certainly worthy of consideration, and may probably lead to some curious and valuable invention.

2. "How ten thousand persons may use those seals to all and every of the purposes aforesaid, and yet keep their secrets from any but whom they please."

Locks have been constructed that can only be opened by the mutation of moveable pieces, and their positions, indicated by letters or other marks, may be arbitrarily agreed upon; so that the maker himself is unable to open them without being informed of the proper combination; this is an approximation to the foregoing invention.

3. "A cypher and character so contrived, that one line without returns and circumflexes, stands for each and every of the twenty-four letters; and as ready to be made for the one letter as the other.

4. "This invention refined, and so abbreviated, that a point only showeth distinctly and significantly any of the twenty-four letters; and these very points to be made with two pens, so that no time will be lost, but as one finger riseth the other may make the following letter, never clogging the memory with several figures for words and combination of letters, which, with ease, and void of confusion, are thus speedily and punctually letter for letter, set down by naked and not multiplied points. And nothing can be less than a point, the mathematical definition being *cujus pars nulla*; and of a motion no swifter imaginable than semiquavers or releshes, yet applicable to this manner of writing."

This is only an exaggerated description of the art of stenography or short-hand writing; but the following invention is too absurd to be entertained:—"A circular motion along a rule," and a single point forming ten sheets of writing "with-

out standing twice for the same letter," are gross and manifest contradictions, and offensive to common and all other kinds of sense.

5. "A way by a circular motion, either along a rule or ring-wise, to vary any alphabet, even this of points, so that the self same point individually placed, without the least additional mark or variation of place, shall stand for all the twenty-four letters, and not for the same letter twice in ten sheets of writing; yet as easily and certainly read and known, as if it stood but for one and the self same letter constantly signified.

6. "How at a window, as far as eye can discover black from white, a man may hold discourse with his correspondent, without noise made or notice taken; being, according to occasion given and means afforded, *ex re nata*, and no need of provision before hand; though much better if foreseen and means prepared for it, and a premeditated course taken by mutual consent of parties."

7. "A way to do it by night as well as day, though as dark as pitch is black."

The visual telegraph has accomplished this, and the electrical telegraph recently brought into operation, has far surpassed even the most sanguine anticipations of the Marquis of Worcester.

8. "A way how to level and shoot cannon by night as well as by day, yet by a plain and infallible rule."

9. "An engine, portable in one's pockets, which may be carried and fastened on the inside of the greatest ship *tanquam aliud agens*, and at any appointed minute, though a week after, either by day or night, it shall irrecoverably sink the ship."

10. "A way, from a mile off, to dive and fasten a like engine to any ship, so as it may punctually work the same effect, either for time or execution."

11. "How to prevent and safeguard any ship from such attempt by day or night."

A great deal has been done towards the accomplishment of the projected inventions in Nos. 9, 10, and 11; No. 8 may furnish matter for deep study and research.

12. "A way to make a ship not possible to be sunk, though shot a hundred times betwixt wind and water by cannon, and should she lose a whole plank, yet in half an hour's time should be made as fit to sail as before."

13. "How to make such false decks as in a moment should kill and take prisoners as many as should board the ship, without blowing the decks up, or destroying them from being reducible, and in a quarter of an hour's time should recover their former shape, and to be made fit for any employment without discovering the secret."

14. "How to bring a force to weigh up an anchor, or to do any forcible exploit in the narrowest or lowest room in any ship, where few hands shall do the work of many; and many hands applicable to the main force, some standing, others sitting, and by virtue of their several helps, a great force augmented in little room, as effectual as if there were sufficient space to go about with an axle-tree, and work far from the centre."

15. "A way how to make a boat work itself against wind and tide, yea, both without the help of man or beast; yet so that the wind or tide, though directly opposite, shall force the ship or boat against itself; and in no point of the compass, but it shall be effectual as if the wind were in the pupp, or the stream actually in the course it is to steer, according to which the oars shall row, and necessary motions work and move towards the desired port or point of the compass."

The recent application of steam power to navigation, has achieved all that is here proposed; but the means employed are widely different from those indicated in the text of the invention, which are impracticable; for should the wind and tide move in the same direction, and with the same velocity, a ship moving with them, would remain relatively at rest, and would therefore receive no further impulse after it had attained the velocity of the wind and tide. For the same reason, a balloon moving with the same velocity as the wind, cannot be made to alter its course by any construction of fixed sails. Its situation with respect to the current of the wind, is exactly the same as it would be in a quiescent atmosphere with respect to absolute rest.

16. "How to make a sea castle or fortification cannon proof, and capable of a thousand men, yet sailable at pleasure to defend a passage, or in an hour's time to divide itself into three ships as fit and trimmed to sail as before; and even while it is a fort or castle they shall be unanimously steered, and effectually be driven by an indifferent strong wind."

17. "How to make upon the Thames a floating garden of pleasure, with trees, flowers, banqueting houses, and fountains, stews for all kind of fishes, a reserve for snow to keep wine in, delicate bathing places, and the like; with music made with mills; and all in the midst of the stream, where it is most rapid."

18. "An artificial fountain, to be turned like an hour glass, by a child, in the twinkling of an eye, in holding great quantity of water, and of force sufficient to make snow, ice, and thunder, with a chirping and singing of birds, and showing of several shapes and effects usual to fountains of pleasure."

When the author says of this invention, that it was "*by me already practised*," many of our readers will probably be inclined to doubt his veracity; if they do so, we most cordially concur with them in entertaining that doubt.

(*To be continued.*)

ADAMS'S PATENT RAILWAY CARRIAGE SPRINGS.

The application of a newly-invented spring to railway carriages, has satisfied many persons competent to decide on its merits, that it will be the means of several highly desirable changes in the construction and fitting up of almost every kind of vehicle used on railways.

The spring alluded to is the invention of Mr. Wm. Adams, the eminent coachmaker of Drury-lane, and author of the very clever, entertaining, and instructive volume lately published under the title of "English Pleasure Carriages." It was invented by Mr. Adams about a year ago, and has already been very successfully applied by him to private common road carriages. It is called, from its form, the "Bow Spring." The back is made of a single bar of well-tempered steel, which is attached at the middle, lengthwise, to the axletree. The *string*, or what may be so sidered, consists of two equal lengths of single bar steel or prepared hempen cord, the inner ends of which are linked to the body or frame of the carriage. The contrivances may, in fact, be said to consist of three springs—the back, or bow-shaped spring, and the two straight springs which form the cord of the arc, but all three acting simultaneously and in harmony with one another. As the two straight springs play as well forwards as backwards, they serve to prevent any longitudinal concussion, whether the engine be drawing or propelling, or whether the carriages continue moving in one direction or are brought suddenly to a stand still. The only direction in which they do not play (independently of the carriage) is from side to side; and therein consists a great excellence, since they thereby help to give lateral firmness to the whole locomotive frame, and to keep it steadily in the line of motion—a line which it is needless to say cannot be too straight. The strength of all the three springs may be made proportionate to the weight of the carriage to which they are applied, consideration being paid to the kind of work to be done, and the quality of the road to travel; and as their greatest strength may be always tested beforehand, and no springs need be used that have not been tested to be capable of bearing a much greater strain than any which they are likely to be subjected to when in actual use, they may be said, in point of safety, to leave nothing to desire.

All these matters having been proved in respect to private common-road carriages of different kinds, and Mr. Adams having satisfactorily shown that "English *Pleasure* Carriages" give a great deal more *pleasure* with a bow not always bent, but relaxed as circumstances may require, it was determined that an experiment should be made to ascertain whether the *bow spring* might not be, with equal advantage, applied to railway carriages. A set of Mr. Adams's springs was accordingly fitted to one of the Post office carriages on the London and Birmingham Railway, and on the 17th of April last, a carriage provided with the bow springs, started in a train train from the station at Euston-grove.

The carriage in question had been at the station for several days before the 17th, and was inspected by many persons, several of whom—those, especially, connected with the railway—expressed an opinion that the springs were ill adapted to railway locomotion, and that the experiment about to be tried would fail—in more ways, too, than one.

It was said that the springs were too light:

That they would allow a great deal too much motion:

That as there were no side guides to keep the axles true, the carriage would run off the rails:

And that they were not strong enough, and would be broken long before the train reached Birmingham.

The result of this difference of speculative opinion was, a great anxiety to see how the actual railway experiment came off (as the sporting phrase is). Among those who took seats inside the carriage, were the inventor of the spring, and several gentlemen well competent to appreciate the merits of the invention. On the outside were an officer of the Railway Company, and one or two Post-office guards.

From the moment the train started, the superior ease and comfort of the carriage

was felt, and severally acknowledged; but the apprehensions of want of strength in the springs—that the carriage would run off the rails—that they would break, and so forth, still remained, in hardly diminished force, in the minds of several individuals of the party.

At Watford, a pan was filled with water, and placed as nearly as possible in the middle of the carriage, on the floor. As the train attained its full speed, the water in the pan became agitated; at first the motion was irregular, but it soon became circular, and the ultimate effect of the centrifugal action was to throw the water over the pan. By the time the carriage had reached half way between Watford and Tring, nearly half the water had been thrown over the edge of the pan, but no more was thrown over during the remainder of the journey to Tring. At Tring the train stopped to set down and take up passengers; and here Mr. Adams and his friends were congratulated by the Company's conductor and the two Post-office guards on the success of the experiment, so far,—the guards observing that it was by far the easiest carriage they had ever rode upon. They also gave it as their opinion, that the springs were of sufficient strength, and well adapted to keep the carriage upon the rails.

From Tring, the gentlemen who had witnessed the preceding experiment, returned to town in a first-rate speed carriage, placed at the same relative point in the train as was the carriage in which they travelled to Tring. In the middle of the carriage to which they had thus transferred themselves, and on the floor, they placed the pan before made use of, with the water which remained in it. As the train attained its full speed, the water became agitated; at first it flew upwards in jerks, but it soon assumed a vibrating motion from side to side, and was forcibly thrown out on each side,—ultimately, in quick succession,—thus showing the great superiority of the apparently slight and elastic "Bow Springs" over the heavy, clumsy, lapped, and all but rigid springs in common use.

The equability of the motion of the bow springs was such, that Mr. Adams, while the train was returning at the top of its speed, made a pencil drawing of the invention for a gentleman in the carriage, which it would have been impossible for him to have done in the carriage in which he returned to London.

One of the passengers by the outward train was Lord Macdonald, who had seated himself in his own well-hung carriage, placed on a truck with the common springs. At some distance beyond Tring, his lordship accepted an invitation to proceed in the carriage with the bow springs, and travelled in it the remainder of the journey, at the end of which he made some very pointed observations on the superior ease and comfort of the carriage compared even with his own.

The carriage was taken onwards from Birmingham to Liverpool, was returned to Birmingham, and was tried by several of the Directors of the London and Birmingham line, who are well qualified to judge of its merits, and by whom it is highly spoken of.

The application of the "bow springs" to every description of railway carriages, will be attended with the following very prominent advantages:—

1. A great diminution of friction.

2. Diminution also of weight—because the elasticity of the springs, and the equable motion they produce, will admit of considerable reduction in the weight of almost any part of railway vehicles, and also in the fitting up of locomotive engines.

3. Security of position on the rails. It has hitherto been deemed necessary to keep the axles in their positions by means of side guides, which, however, prevent them from accommodating themselves to any of the unavoidable inequalities of the railway.

4. Adaptation to all changes of circumstances. It has been found by exact measurements, that the axles of many railway carriages are not placed accurately paral el and cannot run true on the same line, the consequences of which are increased friction, increased wear and tear of the rails, the wheels, and the carriages, great additional weight in every part of the carriages to enable them to withstand the violent oscillations and concussions which even a small deviation (at high velocities) from true parallelism in the axles must occasion, while the power given by the bow strings to each wheel to accommodate itself to every ordinary inequality and impediment, is a remedy for all, or nearly all, of the evils to which reference has been made.

Looking at the invention as a whole, it is important to observe, that it is one which in no respect depends upon fashion or opinion. It is of so simple and practical a character, that a very brief experience must suffice to settle, beyond all dispute, and for ever, the question of its utility; and should the result be as favourable to the superiority of the bow spring as we confidently anticipate, then

will railway travelling become all that we can ever hope to see realized in point of luxurious ease and equality of motion.—*Railway Times.*

ORIGIN OF THE ART OF PRINTING.

When we contemplate the glorious achievements of the science and industry of man; when we see machinery performing the most complicated operations of manual labour, and the unbounded, but obedient power of steam, superceding and surpassing the greatest efforts of all animal power; when we see new discoveries continually increasing the vast amount of modern knowledge, we feel conscious that we are living in a golden age of science; but there is one invention, for which we are indebted to our forefathers, mightier in its effects than all the others—the art of printing. The origin of this, like many other great discoveries, is surrounded with mystery and uncertainty; and the art which is destined to enlighten the whole world, and immortalize the works of genius, has neglected to record the name of its own inventor.

It is the opinion of many authors, that we had the first hint of printing from the Chinese; but Mr. Bagford (*Phil. Trans.*, 310) is not of that opinion; for at the time of the discovery we had no knowledge of them; he rather supposes we may more probably have taken it from the ancient Romans; as from their medals, seals, and from the marks or names at the bottom of their sacrificing posts; but if it be certain that cards are as old as our king Henry the Seventh, nothing seems to give so fair a hint for printing as the making of cards, as is evident by the first specimen of printing at Harlem, and by some books in the Bodleian library at Oxford. The colours are laid on by means of patterns pierced like those used for stencilling; but the outlines of the court cards are stamped or printed from an engraving on a block of wood. This Mr. Bagford supposes to have been the first way of printing at Harlem. The hint might also have been taken from MSS. nine hundred years old; for in them the great letters are done by the illuminators, in the same manner as card-making. The next method of printing at Harlem, was by cutting whole forms in wood, from manuscripts, and without pictures. Such Mr. Bagford takes the *donatus* to be, which is mentioned in histories; and this might date from 1450, and some say 1440; this may be plainly demonstrated from copy-books printed at Rome, Venice, in Switzerland, and England as late as 1500. The third method of printing was with single types in wood; but the author of this invention is unknown. It was esteemed so uncommon a thing, that printers carried their letters in bags at their backs, and got money at gentlemen's houses, by printing the names of the family, epitaphs, songs, and other small performances. The fourth improvement of this noble art, was the invention of single types in metal; here we must entirely ascribe the honour to Peter Scheffer, of Grenschen, servant, and afterwards son-in-law to Faust, who entertained him to work at his house at Mentz; and he, observing how industrious his master was to improve this art, undertook it himself, and with much application and industry, brought it to perfection. After he had made several essays, he at last discovered it to his master, Faust, who, making some experiments with his single types, and finding that they would answer his expectation, was so transported with joy, that he promised him his daughter in marriage; this promise he performed, and they continued together, improving this art with great secrecy, till it became known and spread itself over all Europe. Sometimes their names appear at the end of the books they printed, and sometimes not; their dates vary from 1457 to 1490. As for John Guttenburgh, although he is said by several authors to be the first inventor of printing, yet we cannot find one book with his name, and of his printing.

Mr. Bagford conjectures, that printing with plates of pewter, brass, or iron, either engraved or etched, was first practised by the working goldsmiths; for they have a method of taking off the impressions of their work by the smoke of a lamp, which perhaps gave the hint to the engraving on brass: some allusion is made to this in old authors. An account of the origin of printing, which has obtained credit with many, is that of Junius, who ascribes the invention to Laurence Coster, of the city of Harlem. The substance of his narrative is this:—Laurence Coster, of Harlem, amused himself during his walks in the woods, with forming letters of the bark of the beech tree, by means of which he contrived to produce impressions of verses and short sentences on paper. With the assistance of his son-in-law, Thomas, he afterwards invented an ink more tenacious than common ink, which was found to blot and fill the letters. With this new ink he printed a work in the Flemish language, entitled *De Spiegel onser behoc-*

dinge. The leaves of this book were printed on one side only, and the blank sides were afterwards pasted together. After this, Coster abandoned the use of wooden letters, and adopted metal ones. The great profits which he derived from the new art, induced him to employ workmen and increase his establishment. One of his men, named John, robbed his master of all the types and implements used in the printing-office, and proceeded with them to Amsterdam, Cologne, and finally to Mentz, where he printed several works in the year 1412, with the types stolen from Harlem. The introduction of this art into England, is involved in as much mystery as its first invention. Tradition, supported by the authority of our historians, ascribes the first introduction and practice of printing in England, to William Caxton, a mercer of the city of London, who had become acquainted with the whole method of the art during his travels on the Continent; and under the protection of the Abbott of Westminster, he set up a press in the Abbey, and began to print books soon after the year 1471. This tradition was uncontested till a printed book, or chronicle, was discovered in the Archbishop of Canterbury's palace, with the date of its impression, *Oxford, anno* 1468. This was considered as a proof that printing was known and practised at Oxford, several years before Caxton returned to England. The authenticity of this book has, however, been denied by many writers; and all agree that Caxton was the first who introduced metal types in fount, which, in fact, is the chief merit of the invention.

THE DRY ROT.

It is stated as an important fact, and one worthy of general attention, that timber cut in summer resists the dry rot far better than winter-felled timber; that the doctrine of sap being principally in the roots of trees in the winter is false, and should be discarded for the mischief it has already done; and that the truth should be established, which is, that in the winter the sap is in the tubes of the heartwood of the whole tree, roots, and body, and branches, and is there protected from injury by the frost. In the summer the sap is the tubes of the albernum, or outer covering of the heartwood, and when timber is felled at this season, should the dry-rot attack it, the albernum only disappears, and the heartwood remains sound and dry. On the contrary, if the timber is cut when the sap is in the tubes of the heartwood (i. e., in the winter), the disease continues its ravages till the whole is rendered useless.

The above is extracted from the *Railway Times.* Our chief object in referring to so bold an assertion, unsupported by authority or experiment, is to elicit from our correspondents some account of experiments of this nature which they may have witnessed. It is an opinion founded upon long experience, that the most favourable season for felling timber is the winter, or very late in the year; it has also been recommended to remove the bark in the spring, and leave the tree standing till the following winter. Some recommend that the tree should be killed by boring two holes at right angles to each other, through the bottom of the trunk, and all experiments tending to diminish the quantity of sap in the tree at the time of felling, have been favourably reported. This is a question not to be decided by argument, but by trial, since it depends upon natural phenomena, which can only be discovered by observation. Pliny, Vegetius, and Julius Cæsar, with many more old writers, speak of the pernicious effects of felling timber in the spring; and in this they so well agree, that none of them advise the felling of timber for any use before autumn at soonest; others, not till the trees have borne their fruit, which, says Theophrastus, must always be proportionably later, as their fruits are ripe later in the year; others say, not till mid winter. Palladius recommends November; Cato, the winter solstice, with some superstitious reference to the moon. Theophrastus observes, that oak must be felled very late in the winter; according to the emperor Constantine Pogonatus, not till December. They all agree, that timber felled in this way, will neither split, shrink, nor rot in many years. There can be little doubt that the quality and durability of wood, are considerably influenced by the season in which trees are felled; and it is much to be desired that extensive, varied, and accurate experiments should be undertaken for the purpose of ascertaining to a certainty the most favourable season for felling timber, and the best natural means of preserving it from the ravages of that vegetable plague, the dry rot.

RAILWAY CARRIAGE SPRINGS.

The following remarks on the general principles which ought to influence the construction of railway carriages, are from a letter by Mr. Adams, the talented

inventor of the patent springs described in another column:—

All motion is irregular, whether resulting from the simple operations of Nature, or from the complex contrivances of human art, and whenever motion is communicated to rigid bodies in contact with each other, destructive wear is the result. The rounded forms acquired by angular fragments of rock in running streams are an example. But Nature has provided means whereby motion may be continued for long periods without destructive wear. *Compensation for irregularity* is provided through the agency of the two qualities, *flexibility* and *elasticity*. Throughout the vertebrated animal creation, a flexible framework of bones is adapted to constantly changing forms by the elastic agency of muscles and ligaments, and it is preserved unworn through a long series of years. By the agency of flexibility and elasticity, the leaf maintains its place on the tree, and the tree maintains its place in the ground, exposed to the most violent and irregular force of the winds. By means of elastic tendrils resembling spiral springs, the shoots of the vine cling to their supports, and expand and contract as the wind varies.

Those inventions of human art intended for locomotive purposes, which possess the largest amount of flexibility and elasticity, will be found, *cæteris paribus*, the most easily moved, the smoothest in motion, and the most durable.

For vehicles used on the highways for rapid travelling, it has been found absolutely necessary to provide elastic movement, to diminish personal annoyance, arising from the shocks caused by rough surfaces. The advantages of easy draught and increased durability, arising from an elastic structure, have been comparatively disregarded.

At the outset of railroad experiment, the change from a very rough to a smooth and comparatively level surface, was found so great, and so much to facilitate draught, that elasticity of structure was altogether disregarded.

But when speed of travelling became an important object, the evils arising from an inefficient structure began to develop themselves in personal annoyance, and severe destructive wear with a great increase of draught.

The remedies sought after for these evils were, greater geometrical accuracy of form in the carriages and rails, and greater solidity of road. It was deemed possible to make motion regular, and thus reduce friction in its minimum, without resorting to the principle of *compensation*. That which Nature has never attempted, it was imagined that human art could accomplish.

The result is, that it requires a vehicle weighing four tons, to carry eighteen persons on a railroad, while to carry the same number on a highway, a vehicle weighing only one ton is found sufficient, yet the extra roughness and lesser speed on the highway is more than an equivalent for the increased speed and greater smoothness of the railway.

The cause of this difference is, that the vehicle on the highway is provided with *compensation* for irregular motion by a certain amount of flexibility and elasticity in the principal directions from which concussion approaches. The vehicle on the railway is provided with no compensation for irregular motion, save in the direction whence least concussion approaches—the vertical line in which the almost rigid springs act.

Any mechanician who inspects the drawing of my Vertebrated Train Carriage, published by Weale, of Holborn, will at once see that *compensation* is provided for every species of irregular motion through the agency of a flexible body, with elastic spring tension. Friction is reduced to its minimum, and if the springs, cords, or levers, be made of flexible material, the sound of the tires on the road will also be intercepted.

That the amount of irregular motion in the existing carriages is very considerable, cannot be doubted, from the very great wear of the wheel tires. The small irregularities of the rails are multiplied by the velocity, and this is not trifling even when the carriages are accurately made. But in practice the carriages are far from accurate, the axles are sometimes not parallel to each other, and if parallel to each other, they are not at right angles with the line of traction, so that the wheels grind laterally on their flanges; in addition to this, there is the friction on curves, to remedy which, no efficient provision is made, and the very rapid lateral vibration exemplified in the frequent occurrence of damage to the private carriages carried on trucks. The case-hardened oil-axles work longitudinally in the boxes like pistons. By this process the oil is all pumped away, when the hardened surfaces heat and adhere together. An axle calculated to run 5000 miles with once oiling, is thus destroyed by a hundred miles of railway travelling.

It will, of course, be admitted, that the same principle of elastic flexibility which

gives ease to the rider, will in the same proportion diminish the friction of draught, and the following train of consequences must ensue.

With the diminution of friction, less strength and weight of material will be required in the construction of the vehicle.

With the diminution of friction and weight, less engine power will be required for draught.

With less engine power, the weight of the engine will be diminished.

With less weight of engine, a less weight of rail will suffice.

Or, with the same engine power, a reater speed may be attained.

With the rigid trains at present in use, the reverse train of consequences takes place—rigid train—heavier vehicles—increased friction—increased engine power—increased weight of engine—heavier rails—or a diminished rate of speed.

Setting aside the question of passengers' comfort, and looking only to pecuniary savings, flexibility and elasticity are of far more importance in the luggage trains than in those which carry living beings. Living beings are in themselves elastic and alleviate concussion, which is the case with but few kinds of goods. It is well known that bales of unwrought cotton are far lighter in draught than the same weight of cotton woven into cloth. The puzzling question, "which is heaviest, a pound of feathers or a pound of lead?" ceases to be a jest when the question is tried by carriage draught. Let the luggage trucks be properly constructed, and the railroads will sustain no more injury from them than from the passenger carriages.

ADULTERATIONS OF FOOD.

The practice of adulterating almost every article that will admit of it, has become so general, that a tradesman is unable to obtain the price of a genuine article, unless, indeed, he can succeed in establishing an extraordinary reputation, and that confidence which is so essential to a regular trade, but which, unfortunately, is not always bestowed where it is merited. Mr. Accum, speaking of the nefarious practice of mixing injurious ingredients with articles of food, observes, that "The eager and insatiable thirst for gain, which seems to be a leading characteristic of the times, calls into action every human faculty, and gives an irresistible impulse to the power of invention; and where lucre becomes of reigning principle, the possible sacrifice of a fellow-creature's life, is a secondary consideration." Almost every kind of beverage is adultered; ale, beer, and all sorts of spirits are diluted, and different substances, frequently of a deleterious nature, are added, to imitate the appearance and flavour of the genuine article. Ale is perhaps less adulterated by the retailer, than any other liquor. As for wines, Mr. Accum says, "All persons moderately conversant with the subject are aware, that a portion of alum is added to young and meagre wines, for the purpose of brightening their colour; that Brazil wood, or the husks of elderberries and bilberries, which are imported from Germany under the fallacious name of *berry dye*, are employed to impart a deep rich purple tint to red port of a pale colour; that gypsum is used to render cloudy white wines transparent; that an additional astringency is imparted to immature red wines by means of oak wood and saw-dust, and the husks of filberts, and that a mixture of spoiled foreign and home-made wines, is converted into the wretched compound frequently sold in the metropolis by the name of *genuine old port*." The excise will not allow rum to be sold under a certain strength; to avoid this difficulty, a mixture is sold under the appellation of "rum," which is made up without any portion whatever of real rum. The adulteration of bread with the less nutritious meal of potatoes, is notorious; and the use of alum, though denied by the baker, is also well known. The contrivances resorted to in order to conceal this fraud, are exposed by the writer before quoted:—"The baker asserts that he does not put alum into bread; but he is well aware that, in purchasing a certain quantity of flour, he must take a sack of *sharp whites* (a term given to flour contaminated with a quantity of alum), without which it would be impossible for him to produce light, white, and porous bread, from a half-spoiled material.

"The wholesale mealman frequently purchases this spurious commodity (which forms a separate branch of business in the hands of certain individuals), in order to enable himself to sell his decayed and half-spoiled flour.

"Other individuals furnish the baker with alum mixed up with salt, under the obscure denomination of *stuff*. There are wholesale manufacturing chemists, whose sole business is to crystallize alum in such a form as will adapt this salt to the purpose of being mixed in a crystalline state with the crystals of common salt, to disguise the character of the compound. The mixture called *stuff*, is composed of one

part of alum, in minute crystals, and three of common salt."

Many articles are adulterated with harmless ingredients, such as are used in the manufacture of pepper, mustard, vinegar, &c., but others are highly deleterious; and the manufacturer or the tradesman who knowingly mixes pernicious ingredients intended for human food, not only deserves the severest censure, but the highest penalty that the law can inflict.

RAILWAY EXCAVATION.—CURIOUS FACT.

To the Editor of the Mechanic and Chemist.

Sir,—You are probably aware, that in the neighbourhood of Sonning, near Reading, very deep and extensive cutting is in process of execution for the Great Western Railway. Some time since, I had an opportunity of viewing the spot, and it is an interesting sight, when standing on the temporary railway over it, to see hundreds of men hard at work immediately below. But what attracted most attention, and afforded much amusement, was the method of taking the barrows filled with earth, from the bottom up the almost perpendicular embankments on either side. A temporary raised path up the bank is constructed of planks laid lengthways, supported by timber and strong props on each side. This pathway is fixed about parallel to the side of the embankment, at the summit of which a stout post is firmly fastened, having a pulley at its top, over which a tough rope passes, having at the bottom end a large loop, and being at the other affixed to two horses, who walk along the side of the precipice. The labourer (or navigator, as he is called) wheels his earth to the foot of the planks, puts the loop under the body of his barrow, and having taken firm hold of the handles, he gives a signal, when the horses are made to walk briskly on, which draws up the barrow at a rapid pace, and the man has merely to run with it, and guide it in the centre of the plank till he reaches the top, where he alights on a platform, and having disposed of the earth, he descends with his barrow in a somewhat similar manner. Were the labourer thus employed to allow the barrow to deviate at all from its course, to lose his balance, or to let go his hold, his situation would not be of the most enviable nature.

I am, Sir, your obedient servant,

Proportio.

REVIEW.

The Juvenile Naturalist; or, Walks in Spring, Summer, Autumn, and Winter. By the Rev. B. H. Draper. Darton and Clark.

This is an admirable volume, and does the author much credit. It is written in a light and pleasing style, and is supposed to be the topics of conversation between a father and son, as they take their morning, noon, or evening rambles amid the charming scenery with which our beautiful country abounds. As we read, ere we are aware, we are transported to the scenes of our childhood and youth, and for a moment forget the cares of business and of life, as we retrace in our imagination the steps of earlier days. The volume contains upwards of 500 pages, and is illustrated with nearly 100 wood-cuts, the greater portion of which are beautifully executed. Indeed, we have never seen a book of this kind, the appearance and perusal of which has given us greater pleasure. We subjoin an extract:—

"You told me, Papa, you would give me some account of the eyes of animals.

"Well, I will do so; the subject is very curious and interesting. There is a general likeness in eyes; and yet, it will be found, that, on examination, they very much differ. Human beings have six muscles to each eye, that they may move it on either side; but horses, cows, sheep, and other quadrupeds, which habitually incline their heads to the earth in search of food, have a muscle by which the eyeballs are suspended and supported, and which we do not need. This is a wonderful adaptation to the circumstances in which the creature is placed. For example, the eyes of amphibious animals partly agree with those of the fish and the quadruped. The cat, and the tiger, which prowl by night, have a peculiar power of expanding the pupil. The eyes of fish have no apparatus to moisten them, as it would be obviously unnecessary. The eye is formed with consummate skill; it is adapted by Him who formed it to the properties of light. Every eye refracts the light, and brings it to a focus on the retina. Our best, and most perfect glasses, those of Dollond, are by no means equal to the human eye.

"Gnats, and flies, have a great number of eyes; they can see on every side, without any movement of the organs of vision. Fish have a chrystalline, almost round, to fit the eyes to the strong refraction of light in the element in which they live; and

though they have no eyelids, their cornea is horny, to defend their sight.

"I think you told me that the mole has two very small eyes, hid under its velvet coat; and how suited these are to his mode of living, chiefly under ground.

"They are; the adaptation of the faculties of animals to their mode of life is wonderful, and strikingly displays the wisdom of the Creator. Spiders have four, six, or even eight eyes; they are transparent, like so many gems. They can readily see on all sides. The lizard, called the cameleon, can move one eye whilst the other is still; he can fix one on the sky, and the other on the ground. He can glance at all that is behind and before him at once. How manifold, and how surprising, are the works of God!

"You have said nothing about the eyes of birds.

"True; nor of those of many other creatures. It is impossible we should notice, as they deserve, all the works of the Most High. Lord Brougham remarks of the eyes of birds, that 'they require to have them sometimes as flat as possible for protection; and, at other times, as round as possible, that they may see the small objects, flies, and other insects, which they are chasing through the air, and which they pursue with the most unerring certainty. This could only be accomplished by giving them a power of suddenly changing the form of their eyes. Accordingly, there is a set of hard scales placed on the outer coat of their eye, round the place where the light enters; and over these scales are drawn the muscles, or fibres, by which motion is communicated; so that, by acting with these muscles, the bird can press the scales, and squeeze the natural magnifier of the eye into a round shape when it wishes to follow an insect through the air; and can relax the scales, in order to flatten the eye again when it would see a distant object, or move safely through leaves and twigs. This power of altering the shape of the eye is possessed by birds of prey in a very remarkable degree. They can see the smallest objects close to them, and can yet discern larger bodies at vast distances; as a carcase stretched upon the plain, or a dying fish afloat upon the water.'

"Is not the eyelid designed to moisten the eye, and to keep it clean?

"Certainly. 'And a singular provision is made for keeping the surface of the bird's eye clean, for wiping, as it were, the glass of the instrument, and also for protecting it, while rapidly flying through the air, and through thickets, without hindering the sight. Birds are, for these purposes, furnished with a third eyelid; a fine membrane, or skin, which is constantly moved very rapidly over the eye-ball, by two muscles placed in the back of the eye. One of the muscles ends in a loop, the other in a string, which goes through the loop, and is fixed in the corner of the membrane, to pull it backwards and forwards. If you wish to draw anything towards any place with the least force, you must pull directly in the line between the thing and the place; but if you wish to draw it as quickly as possible, and do not regard the loss of force, you must pull it obliquely, by drawing it in two directions at once. Tie a string to a stone, and draw it straight towards you with one hand; then make a loop or another string, and running the first through it, draw one string in each hand, not towards you, but all ways, till both strings are stretched in a straight line; you will see how much swifter the stone moves than it did before, when pulled straight forward. Now this is proved, by mathematical reasoning, to be the necessary consequence of force applied obliquely; there is a loss of power, but a great increase of velocity. The velocity is the thing required to be gained in the third eyelid; and the contrivance is exactly that of a string and a loop, moved each by a muscle, as the two strings are by the hands in the case we have been supposing.'

"As we are speaking of birds, I will mention a circumstance not generally known, that, unlike all other animals, there is a communication between the air vessels of their lungs, and the hollow parts of their bodies; by this means, they can dilate their bodies, as we do a bladder, and thus make themselves lighter when they would either make their flight towards the grounds lower, or rise more easily in the air."

PROGNOSTICS OF THE WEATHER.

From an old work, called, "One Thousand Notable Things."

To know the Weather by the rising and setting of the Sun.—If the sun rise red and fiery, expect wind and rain.—If, at sunrising, it be cloudy, and the clouds vanish away as the sun riseth higher, it is a sure sign of fine weather.—Likewise, if the sun setteth red, it is a sign of fair weather. If it set in a muddy misty colour, it is a sign of rain.

To know the Weather by the Moon.—If the moon shine clear, and not compassed

about with mist, it will be fair weather.—If the moon be compassed about with a circle, like a great wheel, or is misty and dim, wind or rain follows, or snow, within twenty-four hours.

To know the Weather by the Stars.—The stars, more bright than ordinary in summer, signifies great winds and wet.—If they twinkle or blaze in winter, the wind north or east. is a sign of a great frost. When they are seen to fall or shoot, is a sign of a great rain and winds.

To know the Weather by the Clouds.—If they are round and of a dapple-grey colour, and the wind north or east, fair weather for two or three days after.—If the clouds appear like towers or rocks, signify great showers.—If clouds that are small, grow bigger and bigger, it is a sign of much rain. But if great clouds waste and grow less, it is a sign of fair weather.

To know the Weather by Mists.—If they arise from rivers and ponds, and then vanish, fair weather.—If from thence to the hill tops, rain the same day, or two days after.—If a general mist before sun-rising, near full moon, signifies fair weather.—But if such a mist in the new of the moon, signifies rain in the old of the moon. But in the old of the moon, signifies rain in the new.

To know the Weather by the Rainbow.—If two rainbows appear, signifies fair for the present, and two or three days after, rain.—A rainbow appearing after a long drought, is a sign of rain; but after a long time of wet, fair weather.—If it appears big, it is a sign of much wet: but if very red, wind withal.—If a rainbow appears in the morning, it is a sign of small rain, and presently after fair weather.

QUICKSILVER MINE.

A CARNIOLEAN peasant, who drove a small trade in wooden vessels, was in the habit of groping his way into a recess of the mountains, at that time entirely covered with wood, to procure materials for his tubs and pails, which he sometimes finished on the spot. He had placed some pails, over night, in a small pool in a rivulet which flowed from the mountain, for the purpose of seasoning them. To keep them under water, he put into them a quantity of sand, taken from the bed of the stream. In the morning he was scarcely able to lift one of his pails out of the water. He could ascribe this only to the weight of the sand, and sand so heavy was to him a phenomenon, and he carried some of it to the pastor of his village. The latter, suspecting what might be the reason, sent some of it to the Imperial director of the mines, and on examination it was found to contain half its weight of quicksilver. The whole of the department of Idria was immediately declared a domain of the crown, but the mines were first worked by private adventurers, on leases; and the miners still preserve various traditions of the difficulties these speculators had to encounter. Shafts were driven deep into the solid rock, but no quicksilver was found; patience and money were wearing out, and the speculators gradually drew back, leaving it all at last in the hands of one more sanguine and persevering than the rest. He, too, hoped and laboured in vain; ruin came, not quicksilver, and the destitution into which he had plunged his family, by his unsuccessful adventure, brought him to the grave. His widow was compelled to give up the operation, but the workmen declared they would still make an attempt for the family of him who had so long given them bread, and continued their search fourteen days longer without wages. The fourteenth day arrived, but no quicksilver was found. Towards the afternoon, as the workmen, who had been annoyed all day long by sulphurous vapours, and a more uncomfortable atmosphere than usual, were about to give up their task for ever in despondency, and prepare to celebrate, above ground, the festival of their patron saint, of which this happened to be the eve, a shout from the lowest part of the shaft announced that the deeply-concealed vein had at length been dragged from its lurking place. The saint was neglected, and the mercury pursued. It was soon ascertained that the labour and expense of years were sure to be amply repaid. The revived widow prudently sold her right to the government, and since that period, now 400 years ago, Idria has not ceased to pour its thousands into the Imperial treasury.

SOLUTION OF PROBLEM.

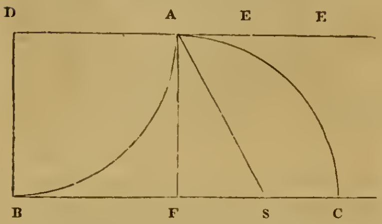
To the Editor of the Mechanic and Chemist.

SIR,—I send you a solution of "A. Z.'s" problem proposed in No. 15 of New Series of your scientific journal.

Assume A D = D B = a. $\cdot 7854 = b$, and let A S represent the line that bisects the space A B C $\therefore a^2 - a^2 b =$ area of the space A F B. If F S is represented by $x \therefore \frac{ax}{2}$

= area of the $\triangle$ A F G. Now the space A B C is evidently = quadrant A D B together with A F B $= a^2$.

$$\therefore a^2 + \frac{ax - a^2b}{2} = \frac{a^2}{2}$$
$$a^2 + ax - 2a^2b = o$$
$$a + x - 2ab = o$$
$$x = 2ab - a$$



Suppose A D or B F = 10 $\therefore x =$ $20 \times \cdot 7854 - 10 = 5 \cdot 708$.

Hence making S F = 5·708, and joining A S, then will A S bisect the space A B C.

I remain yours,

H. BOWLER.

Fetter-lane, April 27.

P.S. Perhaps some of your ingenious correspondents will favour us with a solution of the following equation:—

Given $\sqrt[3]{a + \sqrt{x}} + \sqrt[3]{a - \sqrt{x}} = b^{\frac{1}{3}}$ to determine x.

THE CHEMIST.

ELECTRICITY.

NO. V.

(Continued from page 199.)

To the Editor of the Mechanic and Chemist.

SIR,—Having, in my last paper, described the experiment with the float-wheel, I will now give another, which, though not an experiment on the mechanical effects of electricity, is another confirmation of the one-fluid theory.

14. Fix a hemispherical cup on each of the wires of the universal discharger, and put a small piece of phosphorus in each; set a candle in the place of the table, with its flame parallel to the two cups; on the machine being excited, and the connections made, the flame will be driven invariably from *positive* to negative; and, consequently, the phosphorus in the negative ball is inflamed.

15. Hold a card or a few leaves of paper close to the outside coating, when the jar is charged; then apply the discharging rod, so as to press the paper with one of its balls against the jar, and, with the other, discharge the jar. On examining the paper, a hole will be found to be made through it, and a burr raised on both sides of the paper. This has been used as an argument in favour of the two-fluid theory: but it has been found, that a similar double burr is produced when bullets are fired through sheets of copper.

16. If four pointed wires are fixed in a nut at right angles to each other, and the nut delicately poised on a vertical wire, fixed in the conductor of the machine, the wires being also bent at their extremities in the same direction; when this apparatus is excited, it immediately begins to rotate, in the direction opposite to that in which the points are bent.

17. Nearly fill a phial with oil, put a cork in it, and insert a wire, bent at the lower extremity to a right angle, with its end pointed, so as to touch the glass beneath the surface of the oil; hang this on the conductor; then, when a spark or shock is taken through it, a hole is made opposite to where the wire touched: by applying the point to different parts of its surface, a great number of holes may be produced. In this experiment, the perforation is caused by the passage of the electric fluid through the glass; the oil acts as a non-conductor—preventing the charge from being dispersed; and thus concentrating its whole force to a single point.

18. Place a number of wafers on the table of the discharger, set the points in contacts with them; on passing the charge, the wafers will be scattered in every direction.

19. Place some *loose* gunpowder on the table (as the wafers were) the same effect takes place.

20. Fix a wooden head, with some long hair fastened on it (like what is sold at the philosophical instrument maker's) in the conductor; when excited, the hair begins to diverge in every direction—giving the appearance of fright to the head.

The next experiment I shall give, shows the expansive effects of electricity. I could enumerate several; but the following, I think, is sufficient.

21. Take a piece of glass tube, about 4 inches long and ½ inch diameter, fix a cork in each end, and *perfectly* fill it with water; insert a wire in each cork, with the ends coming within half an inch of each other; then pass a charge through it—the tube will instantly be shattered to pieces by the expansion of the water.

The next branch of the effects of electricity I shall notice, is its chemical pro-

perties. The most simple of this class is its calorific or heating powers; which I shall therefore begin with.

22. Fix a spoon in the conductor, and partly fill it with spirits of wine or ether; warm it, and then take a spark through it —it will generally inflame: but if the machine be not powerful enough, pass a slight shock in the same manner—it will then ignite. In this case, warming is unnecessary.

23. Put a piece of phosphorus in the spoon used in the last experiment, and take a spark through it, or send a slight shock in the same manner—inflammation will take place.

24. If some gunpowder, instead of being laid *loose* (as directed in Exp. 19) be inclosed in a paper case, and the wires of the discharger forced through the ends to within half an inch of each other; by passing a shock through it, it will immediately explode.

25. Take three pieces of plate glass; lay them on the table of the discharger, with a narrow slip of gold leaf passing over each side of the middle one—taking care also, that they do not touch each other; then lay a weight on the whole to press them close together, or two pieces of smooth board, with screws to hold the whole, will do: pass a strong charge through the gold leaf—it will instantly be melted and driven into the glass, tinging it of a brownish colour. The middle piece of glass is mostly broken.

26. Charge a moderate sized jar; then apply a sixpence to the outside coating, by pressing against it with one end of the discharging rod; bring the other end of the rod to the knob, and discharge the jar —the coin will be found slightly soldered to the coating.

27. Stretch a piece of very fine wire, (which is sold for the purpose, of different metals, by Dymond, 146, Holborn Bars), gold is the best I think, between the wires of the universal discharger, and pass a very strong shock through it from a battery, it will instantly become melted, and converted into the oxide of gold, which may be collected on a sheet of paper placed beneath it. This experiment shows the great influence of electricity over bodies subjected to its power; for gold may be kept for weeks in a fused state without acquiring a particle of oxygen from the atmosphere; but we see that electricity causes it to absorb it instantaneously. Having given this instance of its power of causing bodies to unite, I will now give one illustrative of its analytical or disuniting power.

28. Put a little vermillion (the bi-sulphuret of mercury) into a small glass tube, with a cork in each end, thrust a pointed copper wire through each cork; let them come within a short distance of each other; then pass a current of sparks through this apparatus, when, after some time, reduction takes place, the mercury leaving the sulphur mingled with the vermillion, and appearing in its metallic form. In my next paper I shall describe Dr. Wollaston's ingenious process for decomposing water by the machine, and then proceed to the physiological effects of electricity.

ELECTRON.

N.B. An electrical battery, which I should have described in my second paper, is a number of Leyden jars arranged in a box, with all their outside coatings connected together; the insides united by wires passing through the knobs, from one end to the other. By this means, they can all be charged or discharged, at the same time.

Flowers covered by Sublimation.—Into a large glass jar, inverted upon a flat brick tile, and containing near its top a branch of fresh rosemary, or any other shrub moistened with water, introduce a flat thick piece of heated iron, on which place some gum benzoin in powder. In consequence of the heat, the benzoin acid will be separated and ascend in white fumes, which will at length condense and form a most beautiful appearance upon the leaves of the shrub. Other substances may be substituted for benzoin, when the effect will be different. P. T.

Smoky Chimneys.—A machine, called the portafume, for smoky chimneys has been invented by Mr. Bull, furnishing ironmonger, of Adams-street West, Portman-square, and for which he has obtained letters patent. By a simple and effective plan, the wind, however boisterous, is excluded from a chimney without any impediment to the smoke, and every facility for cleaning is afforded. It certainly is a machine that may combine architectural design with utility, and that will admit of application to the palace or the cottage. The use of this invention may prove important to all who are subjected to the nuisance of smoke from the prevalence of stormy or particular winds, and for the sea-coast it must be an invaluable protection to chimneys.—*Charter.*

Phosphorus.—M. Becquerel is of opinion, that electric light renders certain bodies phosphorescent, when they have for some time been exposed to its action. The violet rays possess the greatest degree of this power, while the red rays are entirely destitute of it. Those substances which suffer almost all white rays to pass through them, reduce their phosphorescent property to nearly one half.

The Croydon Railway was opened to the public on Wednesday. The passage to and from Croydon is performed in about thirty minutes; and the fares by the second-class carriages from the terminus at Tooley-street to Croydon is fifteen-pence.

The Southampton Railway will be opened from Croydon to Basingstoke, and from Winchester to Southampton, on Monday next, the 10th instant. The fares by the second-class, exclusive of the intermediate distance, will be 8*s.* 6*d.*

The Derby and Birmingham Junction Railway will be opened to the public at the end of June, or early in July; and by the spring of next year, the railroad to York, by this and the North Midland line, will be opened, giving an entire line from London to that city.—*Derby Mercury.*

Thames Tunnel.—This great national undertaking is rapidly progressing, and the most sanguine expectations are entertained of reaching low-water mark, on the Middlesex shore, before the termination of the summer. The works have now progressed to within thirty-five feet of Trinity low-water mark on the south side, and from the state of the shield and the general appearance of the excavation, it is believed that all danger has been surmounted. When low-water mark is reached, a shaft will be sunk on the opposite side of the river, and the workmen will continue their labours at both ends of the Tunnel. It is expected that the subterranean communication between Surrey and Middlesex for foot-passengers, will be open in about fifteen months.—*Patriot.*

Wages of Labour.—It appears that the average wages paid to the labourers who till the soil of that garden of England, Devonshire, are under eight shillings a week! The price of provisions, as well as house-rent, is, we believe somewhat lower than in London. Tens of thousands of heads of families are toiling for a shilling or fourteen pence a day each, which, supposing them to have a wife and three children, will not be more than eighteen pence a head—less by sixpence than is allowed for the subsistence of a pauper in the Manchester workhouse—nay, less than is paid for the food and clothing of the criminals confined in our New Bailey Prison? Such are the peasantry of beautiful Devonshire. Truly may it be said of that county, " God created a Paradise, and man surrounded it with an atmosphere of misery, and peopled it with wretched victims of selfish legislation!"—*Anti-Corn Law Circular.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, June 11, H. Garnier, Esq., on Education in Germany and England. At a quarter to nine.

Poplar Institution, East India-road. Tuesday, June 11, Mr. Gascoigne, on Shakspeare. Friday, June 14, Discussion, on Masters and Workmen.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, June 13, a Discussion. At eight o'clock.

Mutual Instruction Society, 16, Great Tower-street, Monday, June 10, Mr. Rawley, on Pneumatic Chemistry. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, June 13, George Foggo, Esq., on the Fine Arts. At half-past eight o'clock.

Pestalozzian Academy, Worship-square, Finsbury.—Monday, June 10, Questions for consideration, by T. Wilby, " What conditions should be presented by the mother in the education of her child?"

QUERIES.

What is the method of staining ivory scarlet, and likewise of staining wood black?

J. HERRETT.

The best method of making imitation gold paper; the cheapest and most durable stain for pink paper; and the proper varnish for morocco paper? S. A. C.

How to represent frost on glass. I was told Epsom salts, which I tried first with water, and then with ale, both which experiments failed.

H. M.

In No. 20 (new series) there is a plan of Mr. Langstaff's Velocipede, I shall feel obliged if he will inform me whether it is designed for invalids, the price moderate, and if it can be easily kept under control?

May 8. W.

ANSWERS TO QUERIES.

To make Rice Glue.—" H. E. T." This elegant cement is made by mixing rice flour intimately with cold water, and then gently boiling it. It is beautifully white, and dries almost transparent. Papers pasted with this cement will sooner separate at their own substance, than at their joinings; it is, therefore, extremely useful in the preparation of various paper articles, ladies' work-boxes, &c., which require layers of paper to be cemented together. In every respect it is preferable to paste made with wheat flour.

Coloured Fires.—In the answer to the query of " F. E. L.", concerning the composition of coloured fires, I perceive that those only which are very generally known, are given, I have therefore taken the liberty of transmitting the following addition to the green and purple fire;—It is now so long since I have had anything to do with the " art pyrotechnic," that I will not pretend to give the exact proportion by which the best fires are to be produced, but the experimentor may easily adjust these for himself. The green fire may be produced by substituting for the nitrate of strontia (in the recipe for red fire already given in your periodical) nitrate of baryta; and the purple fire, by substituting chloride of copper in like mannner. By varying the proportions of the ingredients according to the results produced, a few experiments will decide which is the best to be adopted. I have always found it advantageous in the preparation of these fires, to render the various nitrates used in these compositions, unhydrous; as, by depriving them of their water

of crystallization (which is considerable), their burning is much improved. All that is necessary to effect this, is to expose them, when powdered, to a heat of 200o Fah. in a plate. They should, after this, be secured from the atmosphere in bottles. Respecting the suggestion of your correspondent as to the substitution of the nitrate of potass in place of the chlorate, I can say, from my own observations, that it answers extremely well, particularly when treated as before-mentioned; I am inclined, however, to give the preference to the chlorate in preparing these fires for burning in open cases; but if they are to be made into balls for the purpose of heading sky-rockets, the nitrate of potass certainly answers best.

J. J. B.

To remove Fruit Stains.—" P. Truman." Stains of most kinds of fruit, wine, cider, &c., are in general easily effaced by means of oxy-muriatic acid; a few drops of the liquid used on a fresh stain, causes it almost instantly to disappear. Some fruits, such as plums, require the process to be repeated. A very easy method of applying the oxy-muriatic acid in the state of gas, is to take a table spoonful of muriatic acid, and pour it on a tea spoonful of manganese in powder in a teacup; place the cup in a large vessel filled with hot water, and expose the stained spot, moistened with water, to the fumes which arise from the mixture. This operation should be performed under a chimney, that the offensive vapour may be carried off. Such stains may also be effaced by means of sulphurous acid, either in the liquid form, or in the state of gas; and a very easy and economical method of employing the sulphurous acid gas is, to moisten the stained part of the cloth with water, and to expose it to the fumes evolved by burning two or three matches. Stains on silk may be removed by a similar process, or by an aqueous solution of the same acid.

W. P.

To prepare Bladders.—Sir, I would recommend " J. A." (No. 25, N. S.) to wash the bladders in a strong solution of soda in boiling water; the heat of the water melts the fat, which, combining with the alkali, form a soap, which must be removed by subsequent rincings in warm water; then distend the bladder with wind as much as possible, and cut off the superfluous fat and skin; again wash it in the alkaline solution, and rince it as before. Another method is to soak them in lime water, by which means the fat, &c. may be easily removed; but if you are not very careful, the lime seizes the whole of the gelatine (to which they owe their pliability), and renders them very hard and brittle when dry. I use a good many myself, and always find the first method the best.

Oxford-street. Erasmus the Elder.

To remove Ink Stains.—The stains of common writing ink on cloth, paper, or wood, may be extracted by means of almost all the acids; but as the vegetable acids can be employed with less danger to the texture of the substance to be purified, they are to be preferred. All that is necessary is, to moisten the spot with a solution of oxalic, citric, or tartaric acids, in water, and the applications are to be repeated till the spots disappear. As the acids produce no effect on printing ink, they may be effectually employed in discharging written characters from books without injury to the text. But similar stains are effectually removed, and under proper management with equal safety, by very diluted solutions of sulphuric or muriatic acids. The vegetable acids which are employed for this purpose, are sold in the shops under the name of salt of sorrel and essence of lemon.

" W. W." Should the above remedy not succeed in removing the stains in a carpet, I can give you another. E. J. S.

TO CORRESPONDENTS.

Erasmus the Elder.—*His request shall be complied with when we find the correction to which he refers; the books have been received, and will be attended to. We shall always be glad to receive and insert any interesting communication from our worthy correspondent, but we fear that the extracts he proposes, from the old chemical masters, would throw but little light (and that little a false light) upon chemical science.*

Electron *will perceive that we are approximating towards the system he recommends regarding the insertion of queries: we now take the liberty of curtailing them of their fair proportions of compliments, &c., thereby economising much space.*

J. W. *will find his queries answered in an article on " Coloured Lights," in our next number.*

O. P. *is perfectly right.*

C. H. S. *has by no means solved the problem of* A. Z. *The diagram was sent to the engraver's by mistake; it ought not to have been inserted.*

H. M.—*His question, relating to surgery, does not come within the scope or intention of this work; the operation he proposes would probably be attended with some danger, and therefore should not be done without the assent of some experienced person.*

C. A. B.—*If he will call upon Mr. Doudney (City Press), he will obtain the information he requires. An instrument for registering every change of the wind which takes place every twenty-four hours is easily constructed, upon the same principle as the instruments which register the fluctuations of the barometer, &c., that is, by the action of a point upon some circular or other surface, moved by a clock. If he would like his contrivance to be published, we will give him our opinion, and probably insert it, if he will forward us a drawing and description of it.*

T. B. P.—*The usual working hours of wood turners are from six in the morning to eight in the evening; when there is a misunderstanding between a master and apprentice, if the difference cannot be amicably adjusted, the complaining party should apply to a magistrate, or, if in the city, to the Chamberlain.*

London: Printed at " The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell-street, Strand: and may be had of all Booksellers and Newsmen in Town and Country.

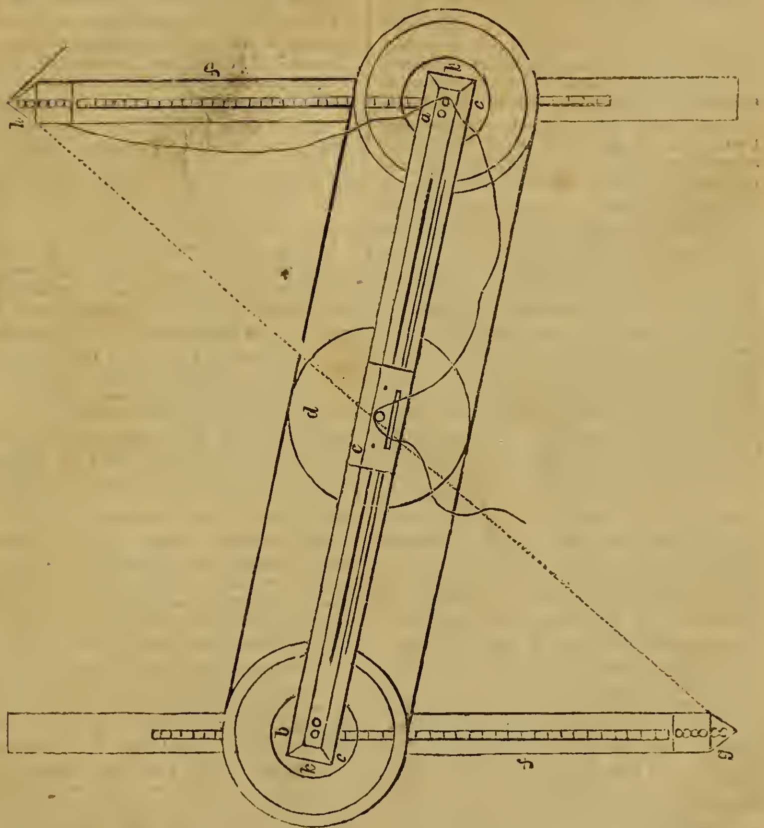
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXVIII. NEW SERIES. | SATURDAY, JUNE 15, 1839. PRICE ONE PENNY. | No. CXLIX. OLD SERIES.

WALLACE'S EIDOGRAPH.



City Press, 1, Long-lane, Aldersgate Street: D. A. Doudney.

WALLACE'S EIDOGRAPH.

(See engraving, front page.)

By means of this instrument, a picture of any kind may be accurately and expeditiously copied, and the copy may be made to have any required proportion to the original.

The principal or central beam, which is made of mahogany, slides backward and forward in a socket in the centre; the socket turns on a vertical axis, supported by a fulcrum, which stands on a table. There is a slit in the beam, through which the axis of the socket passes, so that when the beam slides in the socket, a portion of it passes on each side of the axis. There are two equal wheels below the beam, which turn on axes that pass through pipes fixed at *a*, *b*, near its extremities; and a steel chain passes over the wheels as a band, by which motion may be communicated from one to another. There are two arms, *f*, *f*, which slide in sockets along the lower face of the wheels, just under their centres; at the extremity, *g*, of one arm, there is a metal tracer, with a handle attached to it, by which its points may be carried over the lines in any design; and at *h*, the extremity of the other arm, there is a black-lead pencil fixed in a metal tube, which is ground to fit so exactly into a pipe, as just to slide up and down. In using the instrument, the pencil in its tube is raised by a thread, which passes over a pulley, and it descends again by a weight with which it is loaded.

From the perfect equality of the wheels, it is easy to see that if the arms attached to them be placed parallel in any one position, they will retain their parallelism, although one of the wheels, and consequently both, be turned on their centres. Supposing, now, that *b*, *c*, and *a*, *c*, the parts into which the axis is divided at the centre, have any proportion whatever to each other, if the distances of the tracing point, *g*, and pencil point, *h*, from the centres of their wheels, have the very same proportion, then it follows, from the elements of geometry, that the tracing point, *g*, the centre, *c*, and the pencil point, *h*, will be in a straight line; and further, that *c*, *g*, and *c*, *h*, the distance of these points from the centre, will have to each other the constant proportion of *c*, *b*, to *c*, *a*, or of *c*, *g*, to *a*, *h*. Such being the geometrical property of the eidograph, if any subject to be copied be fixed to the table on which the instrument stands, and the tracing point be carried over every line of the design, the pencil point will trace a copy in all respects similar to the original. To facilitate the adjustment of the instrument, so that the copy may have any given ratio to the original, there are scales of equal parts on the beam and the two arms.

By these and verniers, both halves of the beam, and equal lengths on the arms, are each divided into one thousand equal parts, and at certain intervals corresponding numbers are marked on them. By means of the scales, when any ratio is assigned, the adjustment is made without the least difficulty.

To avoid any derangement by the chain slipping on the wheels, there are clamps provided which hold it fast to the wheels at points where it never quits them. They are slackened when the instrument is adjusted. A description of this instrument appeared in the *Scientific Gazette*, from whence the above particulars are derived.

CENTURY OF INVENTIONS.

BY THE MARQUIS OF WORCESTER, 1655.

(*Continued from page* 204.)

19. "A little engine within a coach, whereby a child may stop it, and secure all persons within it, and the coachman himself, though the horses be never so unruly in a full career; a child being sufficiently capable to loosen them in what posture soever they should have put themselves, turning never so short; for a child can do it in the twinkling of an eye.

20. "How to bring up water balancewise, so that as little weight or force as will turn a balance will be only needful, more than the weight of the water within the buckets, which counterpoised empty themselves one into the other, the uppermost yielding its water (how great a quantity soever it holds) at the self-same time the lower-most taketh it in, though it be an hundred fathom high.

21. "How to raise water constantly with two buckets only, day and night, without any other force than its own motion, using not so much as any force, wheel, or sucker, nor more pulleys than one, on which the cord or chain rolleth with a bucket fastened at each end. This, I confess, I have seen and learned of the great mathematician Claudius, his studies at Rome, he having made a present thereof unto a cardinal; and I desire not to own any other men's inventions, but, if I set down any, to nominate likewise the inventor.

The fallacy of the two last propositions, betrays a very imperfect notion of the true principles of mechanics; the whole

force exerted by any descending weight, is not, in any degree, affected by any arrangement of leverage, or mechanical advantage, but depends entirely upon its perpendicular descent. The effective force of a descending weight may vary in different cases, owing to an improper construction of the machine, and the inevitable impediments of friction and other external resistance; but *a weight, descending without any other impulse than that of gravity, will, in a given descent, invariably impress the same force upon the bodies which oppose its descent; whether that force be effective in the production of motion in any required direction, or expended upon obstacles which communicate the force to external bodies.* If this proposition could be thoroughly understood by those who imagine, that they can create mechanical power, they would find little difficulty in applying the same principle to the action of elastic springs, and ultimately, understanding the demonstration of the impossibility of perpetual motion.

22. "To make a river in a garden ebb and flow constantly, though twenty feet over, with a child's force, in some private room or place out of sight, and a competent distance from it."

To make it ebb is easy enough; but to make it flow again, would require a force far exceeding that of a child, or the most powerful man.

23. "To set a clock in a castle, the water filling the trenches about it; it shall show by ebbing and flowing the hours, minutes, and seconds, and all the comprehensible motions of the heavens, and counterlibration of the earth, according to Copernicus.

24. "How to increase the strength of a spring to such a height, as to shoot bumbasses and bullets of an hundred pound weight, a steeple height, and a quarter of a mile off and more, stone bowwise, admirable for fire-works, and astonishing of besieged cities, when without warning given by noise, they find themselves so forcibly and dangerously surprised.

25. "How to make a weight that cannot take up an hundred pound, and yet shall take up two hundred pound, and at the self-same distance from the centre, and so proportionably to millions of pounds.

26. "To raise weight as well and as forcibly with the drawing back of the lever, as with the thrusting it forwards; and by that means to lose no time in motion or strength. This I saw in the arsenal at Venice.

27. "A way to move to and fro huge weights, with a most inconsiderable strength from place to place. For example, ten ton, with ten pounds and less; the said ten pounds not to fall lower than it makes the ten ton to advance or retreat upon a level.

28. "A bridge portable in a cart with six horses, which in a few hours' time may be placed over a river half a mile broad, whereon may with much expedition be transported horse, foot, and cannon.

29. "A portable fortification able to contain five hundred fighting men, and yet in six hours' time may be set up, and made cannon proof, upon the side of a river or pass, with cannon mounted upon it, and as complete as a regular fortification, and with half-moons and counterscarps.

30. "A way in one night's time to raise a bulwark twenty or thirty feet high, cannon-proof, and cannon mounted upon it, with men to overlook, command, and batter a town; for though it contain but four pieces, they shall be able to discharge two hundred bullets each hour.

31. "A way how safely and speedily to make an approach to a castle or town-wall, and over the very ditch at noon-day.

32. "How to compose an universal character, methodical and easy to be written, yet intelligible in any language; so that if an Englishman write it in English, a Frenchman, Italian, Spaniard, Irish, Welsh, being scholars, yea, Grecian or Hebritian, shall as perfectly understand it in their own tongue, as if they were perfect English, distinguishing the verbs from the nouns, the numbers, tenses, and cases as properly expressed in their own language, as if it was written in English.

33. "To write with a needle and thread, white, or any colour upon white, or any other colour, so that one stitch shall significantly show any letter, and as readily and easily show the one letter as the other, and fit for any language.

34. To write by a knotted silk string, so that every knot shall signify any letter with a comma, full point, or interrogation, and as legible as with pen and ink upon white paper.

35. "The like, by the fringe of gloves.

36. "By stringing of bracelets.

37. "By pinked gloves.

38. "By holes in the bottom of a sieve.

39. "By a latten or plate lanthorn.

40. "By the smell.

41. "By the taste.

42. By the touch.

Note.—By these three senses as perfectly, distinctly, and unconfusedly, yea, s readily, as by the sight.

43. "How to vary each of these, so that ten thousand may know them, and yet keep the understanding part from any but their correspondent."

EXPLOSION ON BOARD THE ARCHIMEDES STEAM-VESSEL.

On Thursday afternoon (May 30th) an accident of a most alarming nature, and which has been attended with the loss of life, occurred on board the *Archimedes* new steam vessel, in the East India Dock. The vessel is fitted up with Mr. Smith's patent Archimedian propelling screw, which works at the stern of the vessel, and causes no swell. She has already made several experimental voyages with the new propellers, and with great success, about the coast and on the river. A few days ago, the vessel made a trip to Portsmouth, and was present at the launch of the *Queen*, 120 guns. On her return she made about nine miles an hour. She was moored in the East India Dock, at Blackwall, until Thursday, when it was determined to make another experimental trip on the river, which was to decide a very important point in the construction of the engines and machinery, which are of the ordinary description, and manufactured and fitted up by Sir John Rennie and Son, the well-known engineers of Holland-street, Blackfriars-road. For the purpose of ascertaining these particulars, Messrs. Rennie, Mr. Smith (the patentee), Mr. Wimsworth, of Limehouse (builder of the vessel), and several scientific gentlemen, were on board. Soon after two o'clock, the steamer got under weigh, and after making a circuit of the Dock, the flood-gates were opened, and she was about to enter the river. At this time one of the men was absent, having gone ashore to obtain some beer for the people on board, and the engineers were in waiting for him with the levers in their hands, ready to set the machine in motion, when the accident, which has been attended with such very serious consequences, took place. The company upon deck were alarmed by the noise of an explosion below, and on Mr. Wimsworth and Mr. Smith going below to ascertain the cause, they found the boilers had burst, and the steam was issuing from the top, where they had given way, in large quantities. The whole of the persons in the engine-room at the time were more or less injured. Three men, named James M'Millan, second engineer, and Alexander Fraser, and James Scroll, firemen and stokers, were most dreadfully scalded, and were instantly removed into the cabin, where measures were taken to render them assistance, and alleviate their sufferings.

Mr. Broadwater, a surgeon of Poplar, who has taken great interest in the success of the patent-propelling screw, fortunately happened to be on board at the time, and directed the treatment of the sufferers. It was, however, found necessary to remove the men to the *Dreadnought* hospital ship. They were covered with soft linen, and taken on board that institution in a boat. M'Millan died a few minutes after he reached the ship. He was frightfully scalded, and when the explosion took place, was close to the boilers, and was exposed to the whole force of the discharge of steam. The others were found to be so dreadfully injured, that little hope was entertained of their recovery. Had this accident occurred two minutes later, the loss of life would have been very great. The whole of the company were to have been in the engine-room for the purpose of examining the working of the machinery, and amongst them were several gentlemen of great eminence in the scientific world.

It is of the utmost importance that the true cause of these accidents should be ascertained, in order to guard against their recurrence; and it is with a view of affording our readers the best information on the subject, that we give the whole proceedings of the Coroner's inquest. We collect this account from the papers of the day.

CORONER'S INQUEST.

On Friday evening (May 31), at eight o'clock, Mr. C. J. Carttar, the coroner for Kent, and a respectable jury, held an inquest at the Unicorn public-house, Greenwich, on the body of James M'Millan, second engineer of the *Archimedes* new steam-vessel, who was killed by the bursting of a steam-boiler on Thursday afternoon.

The Coroner having sworn the Jury in the usual manner, they proceeded to view the body, which presented a very frightful appearance.

John Cameron having been sworn, stated that he was an engineer, and had charge of the engines in the *Archimedes*, in the East India Dock. The deceased was thirty years of age, and was to have been the engineer to have worked her. He had been bred an engineer. He was on board the *Archimedes* on Thursday, when an experimental trip was about to be taken, and he was occasionally in the engine-room. At two o'clock the vessel

was about to leave the deck, when witness, who was on deck, observed steam to issue from the top of the boilers, and being alarmed, he went to ease the safety valves. Finding he could not relieve them farther, he went down another way to the engine-room, there being such a rush of steam from the hatchway, that a passage that way was impracticable. On arriving at the door which led to the engine-room, he opened it, and discovered the deceased close to the door. On seeing him, he exclaimed, "Good by, John," and attempted to shake hands with him. He told him not to fear, and he was immediately taken into the cabin, and his injuries dressed by a surgeon on board. There was but one entrance to the engine-room by the hatchway, for the captain to enter by. The deceased could not open it on his side, but was obliged to wait till it was opened from the other side. He was lying outside the door. The deceased had been a long time in Messrs. Rennie's employ.

Mr. T. Broadwater, a surgeon, said he was on board the *Archimedes* when the accident took place, and heard a noise while sitting in the cabin contiguous to the engine-room, with Mr. Smith, the patentee. The noise appeared as if one of the steam-cocks was discharging. On proceeding to the door leading to the engine-room, they heard the deceased calling for assistance. On opening it, the deceased rushed out; he was very much scalded, and particularly the tongue and throat, occasioned by his calling out and inhaling the steam. He directed the treatment of the sufferers, and had the deceased removed on board the *Dreadnought* hospital ship an hour after the accident occurred. The *Fame* steamer took the boat in tow, and they got down in a quarter of an hour. The deceased expired a few minutes after he reached the hospital, as witness believed from suffocation. The other men in the engine-room were much scalded, but not internally.

James M'Cullock, surgeon on board the *Dreadnought*, confirmed the evidence of Mr. Broadwater as to the death of the man from internal scalding of the tongue and throat. He was in dreadful agony when he came on board, and expired soon afterwards.

Mr. George Rennie, of Whitehall-place, engineer, deposed that the engines and boiler were constructed under the care of Mr. Talbot, and under the direction of the firm to which the witness belonged. They were constructed on a principle which was to raise a greater quantity of steam from a smaller quantity of fuel, and the water was subjected to a larger surface of iron. The steam was better produced from a temperature of 600° than from white heat, and on this principle the boiler was made. He never made such a large boiler before on such a principle. He thought the boiler was quite strong enough. It was not usual to test boilers, as they had often been injured by so doing, and he did not approve of it. The boiler was made on his premises, of the best materials. The vessel had been out twice for a fortnight, and to Portsmouth, and the valves worked very well. He went on board on Thursday, and saw the steam issuing from the fracture. He ascertained that the water was well up. He was in the engine-room shortly before the explosion, and saw nothing to indicate any danger. He attributed the accident to over-pressure.

Coroner.—Do you consider 8 lbs. an over-pressure?

Mr. Rennie.—No; it would stand a great deal more. I saw the steam rising up very rapidly, and remarked upon it. This was previous to the explosion. He gave no orders to the engineer, that was not his business. He had examined the iron, and it appeared to be good. The long fracture, however, appeared to be faulty in the rivets, but it was difficult to say from what cause. The accident was difficult to account for. When he made an examination that day, he found the valves tight, and not to be moved, but considered it was the effect of the explosion.

The inquest was then adjourned till the following Wednesday, when the investigation was resumed.

Mr. Weston, of the firm of Teesdale, Symes, and Weston, appeared on behalf of the Company, and Mr. Espin, of the firm of Few and Co., Henrietta-street, Covent-garden, in behalf of Mr. Smith, the partner.

At half-past ten, the Jury having assembled,

The Coroner said, it appeared that the men lying on board the *Dreadnought*, who had been injured by the explosion, were not in a fit state to be removed on shore, but they could be examined on board. He proposed, therefore, that the Jury should go on board, and hear what these men had to say, which he understood was not much; they could then return and hear the remainder of the evidence.

The Coroner and Jury then proceeded to the *Dreadnought*, where the two men were lying. Their faces and arms appeared to have been badly burned, but

they were able to converse freely, and suffered no pain.

James Crow being sworn, said—I am an engineer, and was employed to work the *Archimedes* engine. I was in the engine-room, standing by the handle next the boiler when the accident occurred. James M'Millan and another man, I believe, were in the engine-room at the time. I saw M'Millan, but I did not see the other man. M'Millan was standing by the other handle, which was farthest from the boiler on my left hand. There was enough water in the boiler.

What was the first notice you had of anything?—Nothing, till the boiler burst.

What was the effect upon you and the other men in the engine-room?—The room was filled with steam. I ran aft underneath the cabin. It was not the regular way, but the door was fastened, and I got out that way between the wheels and up into the after-cabin. M'Millan was in before me; he did not go through the wheels, but across the shafts.

Did you ever anticipate any mischief arising?—No; I saw too much weight put upon the valve.

Which valve?—The one the spindle stands on.

Who put that weight on?—I lent a hand to put it on myself. It was when we were coming from Margate to London. It was done by Mr. Smith's orders. The extra weight put on was a spanner, a piece of pipe and a small piece of lead. I cannot tell what was ths exact weight of the piece of pipe. It might be about 16 lbs. or 18 lbs. weight; it was under 20 lbs. The valves all worked properly. I never saw any defect in them.

Was the extra weight on, on this particular day?—Oh no, I don't think it was.

Did you imagine the placing of these extra weights on the valve had strained the boiler?—No, I should not think it would strain them.

Was there any discussion as to the propriety of putting on these weights?—None at all.

Was Mr. Rennie aware of it?—No, he was not on board. The boilers and engine were under Mr. Rennie's care; Mr. Smith had nothing to do with them. The extra weight of 15 lb. or 18 lb. was not on the day of the explosion, but the ordinary weight of 28 lb. was on. Mr. Rennie was not on board on the voyage from London to Margate, and could have no knowledge of the extra weight. The 28 lb. weight was put on originally, and remained on always. I saw the weight put on the spindle, and Mr. Rennie was aware of its being on. In coming up from Margate, the extra weight of 16 lb. or 18 lb. was taken off, but the 28 lb. weight remained in.

Mr. Espin begged the Coroner to ask if the witness knew at what power the engines were working?

Witness.—At near about 6 lbs.; between 5 lbs. and 6 lbs.

Coroner.—Then there was 28 lb., and say 6 lbs., making 34 lbs.

Mr. Espin.—That would make it about 6 lbs. to the inch.

In answer to the Coroner, the witness said he had no further information to give.

Alexander Frazer, who was lying in the next berth, was next examined, but nothing of importance was elicited.

Upon the return of the Coroner and Jury to the inn,

Mr. Field was examined.—He stated that he resided at Lambeth, and was an engineer. Was not connected with the Company to which the *Archimedes* belonged, but had been requested to make an inspection of the boiler of that vessel. He found the boiler was of the ordinary low-pressure kind, generally used by steam-boats upon the river. The top of the boiler had been lifted by the pressure of the steam, the crown of it had been distorted, and by that means the safety valve had been stopped from acting, and the spindle jammed, which prevented them acting, to which cause he attributed the accident. He did not see any steam gauges when he made the inspection; unless, therefore, the safety valves acted, the pressure of the steam could not be known. A good engineer might have known from the opening of the cocks, but every man could not. The engineers, in consequence of the jamming, were not able to know the strength of the steam, and that was the reason of the accident. He thought that the holders were not sufficiently strong to bear the pressure he found upon them. If the boiler had been well tied and bound, however, it would have been of sufficient strength.

Mr. Rennie was then examined, and stated that the boiler was intended to bear 6 lb. to the inch. No extra weight was intended to be put on them in this voyage. Steam guages were made, and it was intended to have put them on. They were making experiments previous to handing the vessel over to the owner.

By the Coroner.—You had not time to put on these guages?—No.

But it was your intention to have done so?—Yes.

Do you consider it safe and prudent under any circumstances to go without the guage, either on an experimental trip, or any other journey?—I think it not prudent to dispense with steam guages.

Mr. Rennie, in answer to further questions from the Coroner, stated that he believed the weights were laid on by some of his men, but that it was not by his orders, or with his consent.

Coroner.—Did you object to it?—I objected to it twice to several of our people; and twice I took the weights off myself.

Captain Minton was then examined.—Was master of the *Archimedes*. Was on board the morning of the explosion. The engineers and crew were perfectly sober. Knew nothing of the explosion.

The Coroner summed up.

The Jury, having consulted together for about three quarters of an hour, returned a verdict of *Accidental Death*, with a deodand of 250*l.* on the boilers.

The Foreman said, the Jury did not attribute the accident to any wrong construction of the boiler, and that, if it had not been improperly interfered with, the accident would not have occurred.

The Coroner concurred in the view of the Jury. If the valves had not been improperly interfered with by some person or other, the unfortunate results might not have ensued.

Mr. Smith was sure that no man could feel more hurt than himself at the accident that had occurred. His invention was to save life, and it was his having noticed the many accidents that had occurred from the great swell of the river, caused by the ordinary paddle-wheels, that first led him to consider whether some other mode of propelling vessels could not be adopted by which these occurrences might be obviated.

Mr. Rennie felt it was his duty to state, that he considered no blame whatever could be attributed to Mr. Smith.

It was stated that a liberal subscription had been entered into on behalf of the widow of the deceased, and to which the proprietors had contributed 35*l*.

ANOTHER DREADFUL STEAM-BOAT ACCIDENT.

THE steam-boat George Collier, which lay at the wharf opposite the Custom-house, to undergo repairs, for some time past, left this city on Saturday evening last, between five and six o'clock, for St. Louis. When near the Red River, about eighty miles below Natchez, at half-past one o'clock, a.m., a serious accident occurred, which proved dreadfully destructive of human life. The piston rod, which works in the cylinder, and by which the engine is propelled, being attached by a key or bolt which passes through the T head, gave way at the rent which received the bolt, and being relieved from the immense weight against which it had to struggle, was driven through the cylinder head, and gave free room for the steam to escape. The aft-doors of the deck room were closed; consequently, the effects of the steam were unavoidable upon the *locum tenentes*. The stands were thrown from under two boilers; but the concussion was not severely experienced on the boat. The most of those killed and injured, were in their berths, on the deck aft of the boilers. So soon as the accident occurred, many rushed forward unconsciously in the face of the danger; and, inhaling the heated vapour, instantly perished, or lived to linger a few hours in indescribable misery. It is supposed, that between forty and fifty persons were scalded. The clerk of the Collier rates them at fourty-four; consisting of deck passengers, and part of the crew who had retired or were stationed on watch. We crossed over to see the Collier and examine the extent of her damage. No explosion seems to have taken place; but the immense force of the sudden rupture of the piston at the key, thereby disengaging the whole propelling power from the machinery by which the boat was moved, impelled from the screws the cylinder head, and deranged the boiler-stands—thereby causing a current of heated vapour to escape, which was fatal to all who came in contact with, and were exposed to it. We have scarcely ever seen a more heart-rending spectacle than the dreadfully-scalded yet eking out their brief hours of maddening misery, who are yet on board the Collier; and where every attention and kindness is paid them that could be expected, and which may tend to lessen their agony. There are aged mothers, with faces, and hands, and necks, and every portion that could come in contact with the hot air, dreadfully blistered and presenting a horrid spectacle, calling for the lost ones whom they will see no more or for ever. There were strong men, calling aloud in their misery for their Great Protector to relieve them. We cannot conceive how the accident might have been anticipated. We do not remember to have heard of one of a similar kind.—*New Orleans True American.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, June 19, W, Rider, Esq., on Perspective. Friday, June 21, B. R. Haydon, on the Bones. At half-past eight o'clock precisely.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, June 18, T. Claxton, Esq., on the Air Pump and the Properties of Air. At a quarter to nine.

Poplar Institution, East India-road. Tuesday, June 18, R. Ogilvie, Esq., on Natural History.

Islington and Pentonville Philo-Scientific Society, Prospect-House, White-Lion-street. Thursday, June 18, General Meeting, and a Discussion. At eight o'clock.

Mutual Instruction Society, 16, Great Tower street, Monday, June 17, Mr. Hotine, on Botany. At eight o'clock.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, June 20, John Laurens Bicknell, F.R.S., on Magna Charta. At half-past eight o'clock.

ANSWERS TO QUERIES.

"E. G. A." can purchase the ink and other requisites for the purpose of lithography, in George-yard, Lombard-street.

To prevent Mould in Ink.—"J. J." One grain of corrosive sublimate, or three drops of kreosote to a pint of ink, will prevent mould.

"W. P." Gurney's short hand is generally considered the best.

TO CORRESPONDENTS.

A. Z.—*If we were in possession of the information he requires, we should be happy to communicate it, although, as we have before stated, medical science does not come within the scope of this work. It is said that the tooth-ache has been cured by perforations separating the nerves from the diseased part; but the nervous system is so extremely complicated, that little can be expected, and little is obtained by operations of this nature. Erasmus Darwin, in his "Zoonomia," mentions a case of* tic douloureux, *which was not relieved after the separation of several nerves by incisions. To cure the tooth-ache without extracting the tooth, is unquestionably a problem worthy of consideration, not only as a boon to the sufferers, but as a means of possessing what Dr. Johnson would call "the potentiality of accumulating more wealth than avarice could desire."*

O. P.—*The problem of "A. Z." cannot be solved by pure geometry.*

J. J.—*Spirits of wine will prevent ink from freezing, and probably from moulding.*

M. E.—*The best substance for razor strops, is an oxide of iron, obtained by exposing the sulphate of iron to a strong heat. It is sold at the watchmaker's tool shops under the denomination of "red stuff." The finest is of a bright red colour, and the rough is a dark grey, or bluish black; this sort is proper for sharpening knives and coarse instruments; but care must be taken to reduce it to a fine powder, as the rough sort is very hard.*

A Correspondent.—*The problem, or rather the chimera of perpetual motion, has no reference to the durability of the materials of which the machine is composed. The postulatum is a principle by which one body shall transfer to another, more momentum than it possesses itself. The two cases mentioned by our correspondent, would both be considered perpetual motion, notwithstanding the evaporation in the one, and the wearing in the other.*

We must apologize to several correspondents for deferring till next week the insertion or notice of their letters.

LONDON MECHANICS' INSTITUTION. ESTABLISHED 1823.

PRESIDENT—George Birkbeck, Esq., Esq., M.D,

VICE-PRESIDENTS.

Henry Clutterbuck, Esq., M. D.
William Ewart, Esq.
George Grote, Esq., M. P.
Right Hon. Sir Robert Wilmot Horton, Bart., &c.

LECTURES to be delivered during the Quarter, commencing June the 5th, 1839:—

W. E. Hickson, Esq., on Education, and the moral influences attainable by means of Vocal Music, with illustrations by a class of Juvenile Singers: Dr. Cantor, on Education, especially with reference to Female Education: B. R. Haydon, on Fuseli and his Works—on the Bones, and on the Muscles, illustrated by a Living Model: B. Sears, Esq., on the Writings of Charles Dickens: W. Rider, Esq., on Perspective: W. H. Stoker, Esq., on Music: R. Addams, Esq., on Chemistry: J. Tennant, Esq., F. G. S., on Gems and Ornamental Stones used in Jewellery, their composition, locality, mode of working, and means of distinguishing them from composition: W. H. Darker, jun., Esq., on the Properties of Light, particularly its Polarization, and the Hydro-Oxygen Light as applied to Optical purposes: E. Cowper, Esq., on the Pottery and Porcelain Manufacture: J. C. Bowles, Esq., on Lithography: R. A. Ogilvie, Esq., on Electricity.

A Prospectus, giving full particulars, may be obtained at the Institution, No. 29, Southampton-buildings, Chancery-lane.

ANDREW M'FARLANE, Sec.

June 5, 1839.

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THE

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MR. HAMPTON'S PARACHUTE DESCENT.

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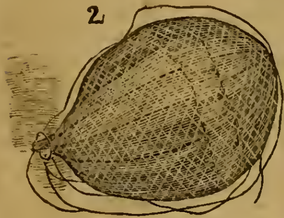

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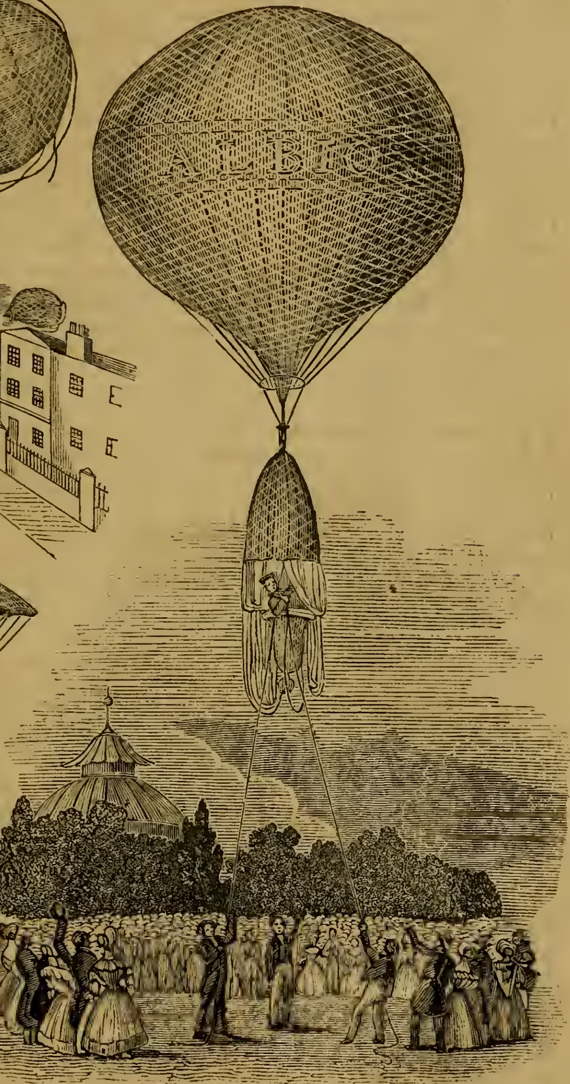

City Press, 1. Long-lane, Aldersgate Street : D. A. Doudney.

MR. HAMPTON'S PARACHUTE DESCENT.

(See engraving, front page.)

It is in the recollection of most of our readers, that a safe descent in a parachute was effected by Mr. Hampton, at Cheltenham last year (Oct. 3). The height of the balloon when the parachute was disengaged, was estimated by Mr. Hampton at one mile and three quarters; but as he had no instrument to assist his observation, and judged only by the apparent magnitude of objects beneath, it is possible that this may be far from the truth. Mr. Hampton affirms, that the time occupied in his descent on that occasion, was twelve minutes and four seconds; and considering the small resisting surface of the parachute (16 feet diameter) compared with the weight appended to it, he could not have quitted the balloon at a lesser altitude than he has stated, if he has accurately reported the time of the descent.

On Thursday, June 13, Mr. Hampton made another ascent in his balloon (the Albion) from the *Stadium*, at Chelsea, and effected a safe descent in his parachute. The weather being unfavourable, and the locality in every respect ill chosen and inconvenient, the ascent did not take place till near half-past eight, when, yielding to the clamour of the assembled company, the truly "intrepid æronaut" quitted his native element with the determination of descending, alive or dead, in that most dangerous of all conveyances, the parachute. Two ballast bags of sand were attached to the bottom of the basket or car in which the traveller rode (or rather *flew*); but not wishing to ascend to any considerable height upon this occasion, Mr. Hampton did not detach them till after he had quitted the balloon. A very few minutes after the departure of the vehicle, ponderous in appearance, but in reality "lighter than air," from the Stadium (Cremorne House), the parachute, with Mr. Hampton, was seen to separate from the balloon, and descend with great rapidity till it disappeared behind some trees. A messenger was instantly sent off in the direction of the balloon, and in about ten minutes returned with the very gratifying intelligence that Mr. Hampton had effected a safe descent at Wallam-green. The basket in descending struck against the roof of a house (the last but one of the Stamford villas, as represented in the engraving), and then descended into the garden behind the house, the car falling on one side of the wall, and the parachute on the other. The car struck against the wall with so much violence, as to cause some injury to Mr. Hampton; but, we are happy to state, it is not of a serious nature; and it is his intention shortly to repeat the experiment *when he can find a convenient place for the purpose.* Some alarm was created by the falling of the sand bags, which many persons mistook for the traveller himself. Papers in the form of diminutive newspapers were thrown out of the car, and caused a good deal of amusement. Amongst other facetious matter, there is an article headed "Trade," in which the reader is informed that "silk is at this moment getting up very much; so are cordages, netting, India rubber, varnish, and various goods appertaining to aerostation. Gas is likewise very progressively on the *rise*, but will be much lower ere long. Sand is falling rapidly."

Mr. Hampton's parachute, though exceedingly simple in its construction, seems better adapted to the purpose for which it is intended, than any that have been hitherto tried. It is 16 feet in diameter, and in the shape of an umbrella; 16 radii or ribs, made of pieces of whalebone, riveted together, extend from the centre to the circumference; they are supported by 16 stays of bamboo, disposed in the same manner as the brass wires in a common umbrella. It is covered with gingham, and from the circumference descends a curtain two yards in breadth. The whole surface is covered with a net, to which 16 cords are attached; there are also 16 cords fastened to the ends of the whalebone ribs. It is closed while ascending, and extended by means of a tackle in the centre, before it is detached from the balloon. A single cord conveyed through a brass tube, serves to suspend the parachute to the balloon, and operate the disjunction when required. Mr. Hampton has a peculiar contrivance (which he does not wish to be divulged at present) for liberating the gas from the balloon immediately after the separation. Upon the last descent, the balloon fell in the garden of Mr. Pocock, not many hundred feet from the spot where the parachute descended. It has been rumoured that Mr. Pocock had unhandsomely detained the balloon; we are happy to state, upon the authority of Mr. Hampton, that so far from that being true, he has experienced the utmost civility and kindness from Mr. Pocock. Mr. Hampton is about to construct several models of different forms of parachutes; when they are completed, our readers shall be informed of the result of the experiments.

Fig, 3 is a stone wall, on which the parachute struck, with the basket thrown on one side; Fig 2, the balloon, with the gas escaping, as represented in engraving.

CENTURY OF INVENTIONS.

BY THE MARQUIS OF WORCESTER, 1655.

(Continued from page 220.)

THE twelve inventions last recited, relate to various modes of wri ing, or substitutes for writing. We only refer to the subject to remark, that No. 34 was not new, being scribed as the method employed by the original native Peruvians. No. 42 is now so far perfected, that complete books have been printed for the blind, the letters being indicated by projections stamped on the paper.

44. "To make a key of a chamber-door, which to your sight hath its wards and rose-pipe but paper-thick, and yet at pleasure in a minute of an hour shall become a perfect pistol, capable to shoot through a breast-plate commonly of carabine proof, with prime, powder, and fire-lock, undiscoverable in a stranger's hand.

45. "How to light a fire and a candle at what hour of the night one awaketh, without rising or putting one's hand out of the bed; and the same thing becomes a serviceable pistol at pleasure; yet by a stranger, not knowing the secret, seemeth but a dexterous tinder-box."

In the days of the Marquis of Worcester, two methods of producing light or fire were known; the burning-glass, and the common tinder-box. We have now the various matches composed of detonating powders, the spongy platinum, ignited by a current of hydrogen, the electrophorus (by which a taper may be lighted from any distance), and many others which, though they do not exactly fulfil the conditions of the above invention, have probably accomplished more than the author ever really expected to be done.

46. "How to make an artificial bird to fly which way and as long as one pleaseth, by or against the wind, sometimes chirping, other times hovering, still tending the way it is designed for.

47. "To make a ball of any metal, which, thrown into a pool or pail of water, shall presently rise from the bottom, and constantly show by the superfices of the water, the hour of the day or night, never rising more out of the water, than just to the minute it showeth of each quarter of the hour; and if by force kept under the water, yet the time is not lost, but recovered as soon as it is permitted to rise to the superfices of the water.

48. "A screwed ascent, instead of stairs, with fit landing-places to the best chambers of each story, with back stairs within the noell of it, convenient for servants to pass up and down to the inward rooms of them unseen and private.

49. "A portable e gine, in way of a tobacco-tongs, whereby a man may get over a wall, or get up again, being come down, finding the coast proving unsecure unto him.

50. "A complete light portable ladder, which, taken out of one's pocket, may be by himself fastened a hundred feet high to get up by from the ground.

51. "A rule of gradation, which, with ease and method, reduceth all things to a private correspondence, most useful for secret intelligence.

52. "How to signify words and a perfect discourse, by jangling of bells of any parish church, or by any musical instrument within hearing, in a seeming way of tuning, or of an unskilful beginner.

53. "A way how to make and hollow a water-screw as big and as long as one pleaseth, in an easy and cheap way.

54. "How to make a water-screw tight, and yet transparent, and free from breaking; but so clear that one may palpably see the water or any heavy thing, how and why it is mounted by turning.

55. "A double water-screw, the innermost to mount the water, and the outermost for it to descend more in number of threads, and consequently in quantity of water, though much shorter than the innermost screw, by which the water ascendeth, a most extraordinary help for the turning of the screw to make the water rise.

56. "To provide and make that all the weights of the descending side of a wheel, shall be perpetually further from the centre, than those of the mounting side, and yet equal in number and heft to the one side as the other. A most incredible thing if not seen, but tried before the late king (of blessed memory) in the Tower, by my directions; two extraordinary ambassadors accompanying his Majesty, and the duke of Richmond and duke of Hamilton, with most of the court attending him. The wheel was fourteen feet over, and forty weights of fifty pounds a-piece. Sir William Balfour, then lieutenant of the Tower, can justify it, with several others. They all saw, that no sooner these great weights passed the diameter line of the lower side, but they hung a foot further from the centre, nor no sooner passed the diameter-line of the upper side, but they hung a foot nearer. Be pleased to judge the consequence.

We have already exposed the fallacy of this contrivance, and judged that the consequence will be, the wheel remaining at rest.

57. "An ebbing and flowing water-work in two vessels, into either of which the water, standing at a level, if a globe be cast in, instead of rising, it presently ebbeth, and so remaineth until a like globe be cast into the other vessel, which the water is no sooner sensible of, but that vessel presently ebbeth, and the other floweth, and so continueth ebbing and flowing, until one or both of the globes be taken out, working some little effect besides its own motion, without the help of any man within sight or hearing; but if either of these globes be taken out with ever so swift or easy a motion, at the very instant the ebbing and flowing ceaseth; for, if during the ebbing you take out the globe, the water of that vessel presently returneth to flow, and never ebbeth after, until the globe be returned into it, and then the motion beginneth as before.

58. "How to make a pistol discharge a dozen times with one loading, and without so much as once new priming requisite, or to change it out of one hand into the other, or stop one's horse.

59. "Another way as fast and effectual, but more proper for carabines.

60. "A way with a flask appropriated unto it, which will furnish either pistol or carabine with a dozen charges in three minutes' time, to do the whole execution of a dozen shots, as soon as one pleaseth, proportionably.

61. "A third way, and particular for muskets, without taking them from their rests to charge or prime, to a like execution, and as fast as the flask, the musket containing but one charge at a time.

62. "A way for a harquebuss, a crock, or ship musket, six upon a carriage, shooting with such expedition, as without danger one may charge, level, and discharge them sixty times in a minute of an hour, two or three together.

63. "A sixth way, most excellent for sakers, differing from the other, yet as swift.

64. "A seventh, tried and approved before the late king (of ever blessed memory), and a hundred lords and commons, in a cannon of eight inches half quarter, to shoot bullets of sixty-four pounds weight, and twenty-four pounds of powder, twenty times in six minutes; so clear from danger, that after all were discharged, a pound of butter did not melt, being laid upon the cannon britch, nor the green oil discoloured that was first anointed and used between the barrel thereof, and the engine having never in it, nor within six six feet, but one charge at a time.

65. "A way that one man in the cabin may govern the whole side of ship-muskets, to the number (if need require) of two or three thousand shots.

66. "A way that, against several avenues to a fort or castle, one man may charge fifty cannons, playing and stopping when he pleaseth, though out of sight of the cannon.

67. "A rare way likewise for musquetoons fastened to the pummel of the saddle, so that a common trooper cannot miss to charge them with twenty or thirty bullets at a time, even in full career."

We are compelled by want of space to defer till next week, our comments on several of the preceding inventions.

HISTORY OF ARCHITECTURE.

NO. IV.

The Romans knew, or at least advanced but little in the practice of architecture prior to their conquest of Greece. It would seem almost superfluous to treat of that little here, especially as, upon the triumph over Greece, they would (had they been ignorant before) have soon become acquainted with the rudiments of the art. But even, with all the advantages of Grecian models and examples, we find that, for some considerable time, the art was almost dormant. This is accounted for by the fact, that the Romans were, at the time to which I allude, a warlike and uncivilized nation, little given to the study of the fine arts and science, and caring less about the proportion and appearance of their edifices. We cannot, therefore, be much surprised that architecture made so little progress when under such unpropitious auspices. In this state the art continued until the reign of Augustus, which refined monarch having patronized this, as well as other useful arts, it quickly reached to a high standard of excellence, and many of its examples, though less generally pleasing than the Grecian, have received the unbounded approbation of eminent architects and artists. If space permit, we will just notice the orders of Roman architecture, with an example or so to each. First, then, we take the *Doric*, which is but a degeneration of the Grecian. It is worthy of remark, that, in all Roman and Grecian specimens of this order, the column is made without a base, and this simple circumstance completely overthrows the evidence of Vitruvius on this subject. *He* affirms, that the columns and their proportions were suggested by the *human figure*, and that the bases represented feet. Why! Here we have in every instance a column without a base! A man without feet! which instantly shows the falsity and absurdity of his statement. The the-

atre of Marcellus is considered the best example of this order, in which the columns are eight diameters in height. As a *religious* specimen, might be mentioned the temple of Cora, where the columns are particularly slender. The Roman *Ionic* is also far less elegant than the Grecian. As examples, I would produce the Temple of Fortuna, Virilis, and of Concord. The former of these is by much the most worthy of notice. It is pseudo-peripteral, which is, having the columns of the flanks attached to walls. The columns are about nine diameters high. Of the latter specimen of this order, a modern writer observes:—"Whoever compares the meagre petty form of the capital of the Temple of Concord, with that of the Erectheum, must instantly, whatever be his former prejudices, perceive the amazing difference, and unhesitatingly acknowledge the vast superiority of the latter." The Roman *Corinthian* differs much, in every example, both in its general and detailed proportions, from the Grecian. The example of this order, which can boast of considerable elegance, and has received most general admiration, is that of some columns in the Campo Vaccino, which are ten diameters high in the clear. Other variations of this order exist in the Temple of Mars Ultor, the Temple of Vesta at Tivoli (whose columns were similar to those used in the Bank of England), and many others. The *Composite*, styled also the *Roman* order, is a mixture of the Doric, Ionic, and Corinthian. The capital being composed of the Ionic volute, and the Corinthian foliage, and the Doric style being brought forward with the others in the mouldings, ornaments, &c., of the entablature. This accounts for its name —*Composits.* An example of this order is in the arch of Titus, and the reader may see specimens of this style about St. Paul's cathedral.

Roman structures were principally of brick, and not of such costly materials as Grecian. The grand auxiliary to Roman architecture, and of which the Greeks were ignorant, was the knowledge of the principle of the *arch.* This was continually used, and contributed not a little to the beauty of Roman edifices.

PROPORTIO.

THE NELSON TESTIMONIAL.

EXHIBITION AT CROCKFORD'S LATE BAZAAR.

THE present exhibition of drawings and models is much larger than the former one. Without offering an opinion upon their particular merits, we merely enumerate a few of the models:—

Mr. Railton, whose model obtained the prize on the former occasion, has added another, with some slight alterations, the principal of which is, taking away the gallery which was situated at the top of the cap.

Near to this is a model by Mr. Goldicut. At the last competition the same gentleman sent a drawing representing Nelson standing upon a globe of about thirty feet in diameter, to be composed of granite. This globe was to occupy a circular space filled with water. He has now carried the design out in a model.

To the left is Mr. Granville's drawing for a column to be executed in iron.

There is a model by Mr. Watson, which, when executed, will be about sixty feet high. Nelson stands on the summit in a short-tailed coat.

Bailey has sent his former model again, with a few alterations, such as lengthening the obelisk, and taking away a railing and substituting steps. He has also sent another. Its composition is an octagon base, from four sides of which is a projection surmounted by a sea-horse. On the upper part of the octagon are three figures representing sea-gods. A structure rises from the middle of them, which is decorated with the prows of vessels, over which are figures of Fame in full relief. On the top is the statue of Nelson.

A little further on we find the model of Sievier and Fowler, which also won a prize. The lamps and trophies have been taken away, and lions are placed at the angles, which gives it a bold and grand appearance. In support of the union of architecture and sculpture, the artists say: "The composition presented by the accompanying model is intended to combine architecture with sculpture, in order to obtain a more striking effect from their union, than either is calculated to produce separately: the one by its form and mass, being calculated to arrest the attention and make a general impression, which may be heightened and perfected by the more refined and interesting details of the other. With respect to the first, it may be observed, as the result of existing instances, that a mere structure cannot properly convey the feeling, or produce the effect required in the erection of a monument to commemorate any celebrated character or event: whilst, on the other hand, a statue or group of sculpture is ineffective for want of mass and distinctness of form and outline: the former is appreciated only as a distinct object, and the latter on close

inspection. The object, therefore, has been to combine the advantages peculiar to each art, so that the many who pass along may be struck with the general aspect of the monument; and the few who may pause to examine its details, may find their first impression carried forward and perfected by the beauty and significance of its historical illustrations."

Mr. Park has three models, which seem to be made from the two he had at the last competition. Nelson, with his cocked-hat on the top of one of them, has a very grotesque appearance.

Mr. Nichols has sent one of the three towers he exhibited last, with a few alterations.

Mr. Shaw has sent his drawing in again with the alteration of taking away the shaft of his column, and placing the figure of Nelson the pedestal.

THE BUDE LIGHT.—VENTILATION.

Various opinions are entertained of the Bude light lately tried in the House of Commons; some considering it of greater brilliancy, and otherwise superior to the common wax lights, and others describing it as "resembling snap-dragon, or the light in Freischuts," and introducing many inconveniences which do not attend the common lights. The following is extracted from a letter by Sir Frederick French:—

"It is taken for granted, by the favourers of the Bude light, that no accident can by possibility occur on the narrow roof of the House of Commons; that the lamps or lenses cannot be broken, the depôts of oil cannot by possibility be overturned; that "the large and offensive masses of unconsumed carbon will be ignited and raised to a beautiful and brilliant flame by the oxygen," which is to pass through the centre of each of the 64 burners; and that "whatever heat may be generated by the new process, will be carried off through the roof, and never affect the body of the house." But mark the candour of these philosophers; while the great power of the furnace is to carry off everything offensive from the Bude light, they will not admit the same power to be effective to carry off the heated atmosphere, or the effluvia which must be inseparable from any candle, even of the purest wax. It is said that "one wax candle consumes as much oxygen as two men, and 240 candles will deteriorate the atmosphere as much as the respiration of 700 men." And again, "that the wax lights will make the house hot as a baker's oven;" such are the remarks made in the paragraphs to which I allude. Now what says Mr. Hume on Wednesday the 15th, "The Bude light would have the effect in rendering the ventilation more perfect, and the quantity of candles burning in the house, consumed a greater portion of gas necessary for respiration, than the members themselves did, and besides they produced, in a more or less degree, carbon." To this I ventured to reply, that the Bude light and its machinery must materially impede the current of ventilation, while members would be exposed to all the chances of lamps being broken or extinguished, and the well-known stench arising from any such accident; of oil being upset, and the lenses, perhaps, coming ing down upon the heads of members, with the possibility of being visited by a sleepy messenger tumbling through one of the panels.

This is matter of opinion, but I also ventured to say that, so far from being injurious, every candle contributed mainly to assist ventilation; and to support this opinion, I will now quote a few sentences from the evidence of men whose opinions are of more importance than those of either Mr. Hume or Sir Frederick Trench. First, Mr. Birkbeck, in the Report on Ventilation of September 2, 1835.

Question 25.—"Do you not think that lamps or chandeliers might also be made a means of assisting ventilation?"

"Unquestionably; by placing the lights, for instance, underneath your highest aperture, you would give to those apertures something of the effect of a chimney, taking care, however, to do that which people have not generally done, to make openings in the covered space above, by which the heated air may escape."

In the latter part of the answer to question 26, he says, "But I believe that, for the purposes of ventilation, the heat, and consequent ascending force of the air, would be quite sufficient to keep up the discharge from those apertures in the roof, or other suitable places, if there were a well-regulated supply of cold air below."

Question 36.—"Is the Committee to gather from your evidence, that you recommend the lighting to be so high, that oxygen, in the lower part of the room, might be as little consumed as possible?"

Answer.—Certainly; and that the heat liberated in producing the light, might assist the ascending column of air, and promote the ventilation."

W. T. Brand, Esq., states, in question 310, "With the view to create an ascend-

ing current, so that, by proper means, a demand may be made, if requisite, upon any particular apartment, or, at all events, upon the hall or large room below, so as to carry off its foul air from or near the ceiling."

Question 311.—"But with reference to the supply of the fresh air, would it not also be necessary to adopt some means to create an ascending current from the source of supply into the chamber to be ventilated?"

Answer.—"Certainly."

Question 312.—"And would you, for this purpose, also apply heat, as well for ventilating as for warming?"

"No; I think that the ventilation, properly so called, and the warming, ought to be considered distinctly; in regard to ventilation, the great point is to carry off the foul air, which I think is most efficiently done from or near the ceiling, and to do it in such a way as to guard against all possibility of descending currents of cold air."

Again, in question 365, he says, "Those chandeliers are very powerful ventilators, and, when well managed, supply the place of the warm air chamber, which I have already insisted on as essential to good ventilation."

Dr. Reid states, in question 410, "In many of the buildings in which I have been engaged, we not only made provision for the arrangement of ventilation as I have mentioned, but all the lights which are employed, are never allowed to mix their bad air with the atmosphere of the room; the bad air is carried away by an independent tube to the same large branch that leads to the working ventilator."

A Volcanic Island has been formed between the 33rd and 34th degrees of south latitude; between Valparaiso and the island of Juan Fernandez. This phenomenon excites great fears for ships coming from the north, because one island, which is six miles in extent, is precisely in the course of vessels coming to that port. A Valparaiso letter of the 26th of February, given by the *Journal du Havre*, contains the following report from the captain of a Chilian brig:—"On the morning of the 12th, we felt several shocks of an earthquake. A dead calm prevailed at the time, and lasted through the day, the atmosphere being extremely close and hot. Towards evening a breeze got up, and we were able to move two leagues. At seven, we saw rising above the surface of the sea a rock, which, after attaining a certain height, divided into two parts, one inclining horizontally towards the north, the other seeming to be partly crushed by the shock, and becoming less elevated, but broader at the base. The two rocks, after being thus severed, continued to rise higher, and at the same time two other islets appeared near the first. The group ranged from south to north within a space of about nine miles, and about sixty leagues west of Valparaiso. In the night we observed flames similar to those of small volcanic eruptions issuing from the crests of this new archipelago. The next day we were enabled to judge of the height of these new-formed mountains, and calculated the highest to be 400 feet above the surface. Two other ships have also seen this group, and a French corvette on this station has sailed to examine it, and to land some men on the islets, if possible."—*Patriot.*

The Marquis of Tweedale's Drain Tile Machine.—This machine will make 10,000 drain-tiles a-day, one man and two boys to attend it, and 20,000 of flat tiles for the drain-tile to lie upon; but if the tiles are broad for roofing, it will make 12,000 a-day. These draining tiles are 15 inches long, so that three machines would make in one season (of thirty weeks) as many tiles as would lay a drain from London to York. Now a man and two assistants will only make 1,000 drain-tiles in a day, and these only one foot long, which is 1,000 feet per day. While the machine, with the same number of persons, will make 12,000 feet per day; so that if the drain be laid at the distance of twenty-five feet, it will make in one day sufficient tiles for six acres. The advantages are—1st, the tile is much stronger from being compressed, and less pervious to water—it is not only compressed, but it is smoothed over, which gives it a surface as though it were glazed. They are capable of being made from a much stiffer clay than usual, and in nine cases out of ten, the clay may be used directly on being dug, if passed through the crushers, being much drier. Clay unfit for bricks and tiles by the common method, is available by the machinery. The expense of draining will be paid in three years, but not unfrequently in one.—*Farmer's Magazine.*

Ancient Canoe.—In digging last week on the farm of Mr. Whitfield, near the North Drain in Deeping Fen, a canoe of extraordinary antiquity was found. Its length is 36 feet; the outside of one end is five feet eight inches. The thickness of the bottom is about six inches, and of the sides four inches reduced to two and a half. There are ribs inside about four feet apart, for strength, projecting two inches, and about five inches wide. The inside depth at the wide end is three feet four inches, and at the other end two feet. This singular canoe is of oak; it has a sort of keel, and was found lying on oak cross pieces. It is certain that it was hollowed out of one log, which appears to have contained 650 cubic feet. The tendency of fen soil to preserve wood is well known, and the date of this remarkable vessel is placed at a very remote antiquity indeed.—*Lincoln Mercury.*

The Large Wasps, which are seen flying about in the months of April and May, are queen wasps, and, therefore, the destruction of them is the prevention of the birth of myriads of wasps. These powerful enemies of the honey bees are eagerly sought after by apiarians, by whom they are mercilessly destroyed. Earl Fitzwilliam gave a shilling for each wasp brought to him, " dead or

alive," in the months of April and May; his lordship pays more than five or six pounds a year in this way, which he considers a very profitable expenditure as regards the protection of his fruit and honey bees.—*Patriot.*

Organic Remains.—In excavating for the Great Western Railway a few days since, a remarkably fine tusk of the mammoth was discovered, lying on a bed of new red sandstone, about seven feet below the surface, between the Bristol Cotton Works and St. Phillip's bridge. The tusk, together with some very beautiful specimens of iron and lead ore, found near the spot, have been kindly brought to the Philosophic Institution by Dr. Fairbrother, for the inspection of the members and their friends.—*Cambrian.*

Abolition of the Penny Postage.—The Manchester postmaster has received an intimation from the Postmaster-General, to make such preparations and arrangements as he may deem necessary, in order to carry into effect the penny postage.

New Rifle Gun.—The remarkable rifle of seven powers, for which Mr. Wilkinson has taken out patents in all the countries in Europe, was tested a few days ago at a private shooting ground, on the Norland Estate, Nottinghill. Several scientific persons, officers of the two services, and noble amateurs, were present, the experiments being made for the judgment of the master-general of the ordinance. The precision of the piece, the terrible facility of its seven-fold power, its lightness and portability, were highly approved. The cylindrical apparatus which contains the seven charges, is a contrivance at once sure and simple. Ten men so armed are equal to seventy.

Encouragement to Genius.—Mr. George Stephenson, civil engineer, of this town, stated publicly at the recent opening of the York and North Midland Railway, with the truth and simplicity which mark his character, that he commenced his career in life as a plough-boy, and that he was sent out by his parents to labour when he was only eight years of age.—*Newcastle Journal.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, June 26, W. Rider, Esq., on Perspective. Friday, June 28, B. R. Haydon, on the Muscles. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, June 27, Edward W. Elton, Esq., on the Genius and Influence of Shakspeare. At half-past Eight o'clock.

Poplar Institution, East India Road. Tuesday, June 25, A. De Morgan, Esq., on Astronomy.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, June 25, Quarterly Meeting. At a quarter to nine.

ANSWERS TO QUERIES.

To Gild Steel—" W. J. N." Steel may be covered with gold, by making first a solution of that metal in nitro muriatic acid, and then adding a fourth part of ether; shake them together; wait till the fluids separate the upper stratum, ethereal gold is then to be poured off into another vessel. If any polished steel be dipped in this solution, and instantly plunged in water, the surface of the steel will have acquired a coat of pure gold. By this means a few grains of gold may be extended over an immense surface

To Dye Ivory.—" J. Herrett." Ivory may be dyed scarlet, by imbuing it first with a tin mordant (that is, dipping it in a diluted solution of nitro muriate of tin), and then plunging it in a bath of brazil wood and cochineal. Wood may be dyed black by first dipping it in a decoction of logwood, and then steeping it in a solution of sulphate or acetate of iron.

To represent Frost on Glass.—" H. M." Make a perfectly saturated *hot* solution of Epsom salts, and dissolve a little gum in it; he will, I think, find it answer; by wiping the edges of the glass, it will have a very beautiful appearance at a distance. G. W. P.

TO CORRESPONDENTS.

E. C.—*The machine he describes will not produce the effect which he expects; whatever force is applied to a body of mercury, or to any other body, the motion produced will be destroyed by the resistance of an equivalent force; and since action and reaction are always equal, it follows that the mercury cannot exert a greater force than that which produced its motion.*

F. E. L.—*Olive oil cannot be dried without destroying its characteristic properties. It may be divided into two different substances, one of which is called sterine, and resembles wax, and the other is called elain, and remains fluid, unless exposed to a very low temperature.*

A. Z. *is informed by a correspondent (C. D.), that he may obtain the specific which he desires, by applying at No. 2, Paradise-place, Stockwell.*

F. Cobbett.—*In the photogenic process at present known, a white surface becomes coloured by the action of light. M. Daguerre has discovered a method of producing a contrary effect; but the process is not yet divulged.*

B. W. (Sheffield).—*His question is unintelligible to us; but we insert it, rather than trouble him to write again from a distant place. Perhaps some of our readers connected with the trade may understand it: " What are the best ingredients for refining the gold from black lead, red chalk, pipe-clay, and candle-fat, commonly called gilders' washings?"*

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THE

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EXPERIMENTS IN ELECTRICITY.

Fig. 1.

Fig. 2.

Fig. 3.

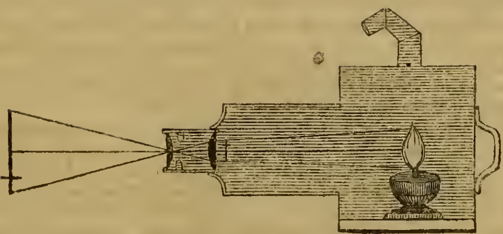


Fig. 4.

City Press, 1, Long-lane, Aldersgate Street: D. A. Doudney.

CENTURY OF INVENTIONS.

BY THE MARQUIS OF WORCESTER, 1655.

(Continued from page 228.)

It is highly probable that the invention described in No. 47 (see our last Number), was really put in practice by the Marquis of Worcester. Let a very small hole be made in a hollow ball (such, for instance, as are used for ball-cocks), with a small weight fixed near the hole, so that the hole shall always remain undermost when the ball is floating freely; then immerse the ball in water, and by means of a condensing pump, the water will be forced through the small aperture into the ball, till the air within is compressed into the same density as that above. If a sufficient quantity of water be injected, the ball will descend so as to leave only a small portion above the surface of the water. If a ball so charged be thrown into a pail of water, it will gradually rise as the water is ejected by the pressure of the internal condensed air; and if lines be marked on the ball at the height of the surface of the water, and equal times elapse between them, the rising of the ball will at any time indicate the hour (the water being injected as before described), *and if kept by force under the water, yet the time is not lost, but recovered as soon as it is permitted to rise to the surfaces of the water.*

In the East Indies, a curious contrivance is practised to show the time. Hollow vessels, called *jumboes,* made of thin brass, and in the shape of the body of a round tea-pot, are floated in a large vessel containing water; in the bottom of each is a hole, the size of which is determined by the time desired to elapse before the vessel fills and sinks. The smallest, which sinks in five minutes, or more or less, according to the degree of precision required, is usually about an inch in diameter, and the largest, when required to remain many hours before it sinks, is as large a sa small washing-tub. When the *jumboes* are placed empty on the water, it is easy to see the hour at any time before they are all filled. Suppose you commence at twelve o'clock; five minutes after, the smallest will be filled and sunk; a quarter of an hour after, the second will sink, and so on to the last. This, or the ancient instrument called *clepsydra,* probably furnished the first hint of this invention. The clepsydra was similar in principle to the hour-glass, but with water instead of sand. Some of them were constructed so that the time was indicated by the rising of the water in the vessel, instead of the time of its emptying. It has been objected, that the rising or falling of the water in these instruments is unequal, varying with the height of the incumbent column of water in the emptying vessel; this inconvenience may, however, be obviated by the graduation of the scale, the form of the vessel, or by the introduction of a floating syphon.

The means of discoursing by musical sounds (mentioned in Number 52), must readily suggest itself to any person acquainted with the practical part of music. The most easy method would be to take a diatonic octave, and let the simple sounds represent the letters from A to H, and then go on by combinations, as C E, C F, &c., for the rest, as agreed upon between the parties. It is an inconvenience that persons unacquainted with music, will be unable to understand this kind of correspondence.

The succeeding inventions up to No. 67, though not literally executed, are, for the most part, surpassed by the steam-gun invented by Mr. Perkins, and a musket invented by M. Robert (a Frenchman), which may be fired twenty or thirty times in a minute.

68.* "An admirable and most forcible way to drive up water by fire, not drawing or sucking it upwards, for that must be, as the philosopher calleth it, "intra sphæram activitatis," which is but at such a distance. But this way hath no bounder, if the vessels be strong enough; for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three quarters full of water, stopping and screwing up the broken end, as also the touch-hole; and making a constant fire under it, within twenty-four hours it burst and made a great crack; so that having a way to make my vessels, so that they are strengthened by the force within them, and the one to fill after the other. I have seen the water run like a constant fountain-stream forty feet high; one vessel of water rarified by fire, driveth up forty of cold water. And a man that tends the work, is but to turn two cocks, that one vessel of water being consumed, another begins to force and refill with cold water, and so successively, the fire being tended and kept constant, which the self-same person may likewise

* A portion of the preceding invention, No. 67, in our last Number, was by mistake omitted; it is as follows:—"When first I gave my thoughts to make guns shoot often, I thought there had been but one only exquisite way inventible, yet by several trials and much charge I have perfectly tried all these."

abundantly perform in the interim between the necessity of turning the said cocks."

Here is a description of the power of steam in its mightiest action, though not usefully applied. This power has been known for thousands of years, but the invention of the steam-engine is not a physical discovery; it is a mechanical invention,—an admirable and sublime application of the known power of steam.

69. "A way how a little triangle-screwed key, not weighing a shilling, shall be capable and strong enough to bolt and unbolt round about a great chest, a hundred bolts through fifty staples, two in each, with a direct contrary motion, and as many more from both sides and ends, and at the self-same time shall fasten it to a place beyond a man's natural strength to take it away; and in one and the same turn both locketh and openeth it.

70. "A key with a rose-turning pipe, and two roses pierced through endwise the bit thereof, with several handsomely-contrived wards, which may likewise do the same effects.

71. "A key perfectly square, with a screw turning within it, and more conceited than any of the rest, and no heavier than the triangle-screwed key, and doth the same effects.

72. "An escocheon to be placed before any of these locks, with these properties: 1. The owner (though a woman) may with her delicate hand vary the ways of coming to open the lock ten millions of times, beyond the knowledge of the smith that made it, or of me who invented it. 2. If a stranger open it, it setteth an alarm a-going, which the stranger cannot stop from running out; and, besides, though none should be within hearing, yet it catcheth his hand, as a trap doth a fox; and, though far from maiming him, yet it leaveth such a mark behind it, as will discover him if suspected; the escocheon or lock plainly showing what moneys he hath taken out of the box to a farthing, and how many times opened since the owner hath been at it.

73. "A transmittable gallery over any ditch or breach in a town-wall, with a blind and parapet cannon-proof.

74. "A door, whereof the turning of a key, with the help and motion of the handle, makes the hinges to be of either side, and to open either inward or outward as one is to enter or to go out, or to open in half.

75. "How a tape or ribbon-weaver may set down a whole discourse, without knowing a letter, or interweaving anything suspicious of other secret than a new-fashioned ribbon.

76. "How to write in the dark as straight as by day or candle-light.

77. "How to make a man fly; which I have tried with a little boy of ten years old, in a barn, from one end to the other, on a hay-mow.

The idea of a man flying, is generally condemned as fallacious and impossible, and even ridiculed as visionary and absurd; but so far from its impossibility being demonstrated, it is the opinion of some eminent mathematicians, that it will ultimately be accomplished to a sufficient extent to render it available for useful purposes. Sir George Cayley, of Brompton, in Yorkshire, has made many experiments with a view of ascertaining to what extent it is possible for a man to fly. The chief obstacle has always been a deficiency of power; but if some artificial power could be applied without considerably increasing the weight, and that power combined with the man's own exertion, it is not improbable that the object might be accomplished.

78. "A watch to go constantly, and yet needs no other winding from the first setting on the chord or chain, unless it be broken, requiring no other care from one, than to be now and then consulted with concerning the hour of the day or night; and if it be laid by a week together it will not err much, but the oftener looked upon, the more exact it showeth the time of the day or night.

79. "A way to lock all the boxes of a cabinet (though never so many) at one time, which were by particular keys appropriated to each lock, opened severally, and independent the one of the other, as much as concerneth the opening of them, and by these means cannot be left open unawares.

80. "How to make a pistol barrel no thicker than a shilling, and yet able to endure a musquet-proof of powder and bullet.

91. "A comb-conveyance carrying of letters without suspicion, the head being opened with a needle-screw, drawing a spring towards them; the comb being made but after an usual form, carried in one's pocket.

82. "A knife, spoon, or fork, in an usual portable case, may have the like conveyances in their handles.

83. "A rasping mill for hartshorn, whereby a child may do the work of half a dozen men, commonly taken up with that work.

84. "An instrument whereby persons

ignorant in arithmetic may perfectly observe numeration and subtractions of all sums and fractions.

85. " A little ball, made in the shape of a plum or pear, being dexterously conveyed or forced into a body's mouth, shall presently shoot forth such and so many bolts of each side, and at both ends, as without the owner's key can neither be opened or filed off, being made of tempered steel, and as effectually locked as an iron chest.

86. " A chair made *à la mode*, and yet a stranger being persuaded to sit down in it, shall have immediately his arms and thighs locked up beyond his own power to loosen them.

87. " A brass mould to cast candles, in which a man may make five hundred dozen a day, and add an ingredient to the tallow which will make it cheaper, and yet so that the candles shall look whiter and last longer.

88. " How to make a brazen or stone head, in the midst of a great field or garden, so artificial and natural, that though a man speak never so softly, and even whispers in the ear thereof, it will presently open its mouth, and resolve the question in French, Latin, Welsh, Irish, or English, in good terms uttering it out of his mouth, and then shut it until the next question be asked.

89. " White silk knotted in the fingers of a pair of white gloves, and so contrived without suspicion, that when playing at primero at cards, one may, without clogging his memory, keepr eckoning of all sixes, sevens, and aces, which he hath discarded.

90. A most dexterous dicing box, with holes transparent, after the usual fashion, with a device so dexterous, that with a knock of it against the table, the four good dice are fastened, and it looseneth four false dice made fit for his purpose."

EARLY PROMOTERS OF LOCOMOTIVE CARRIAGES.

So early as the year 1759, Dr. Robinson (subsequently Professor of Natural Philosophy in the University of Edinburgh), then a student at Glasgow, threw out the idea of applying the power of the steam-engine to the moving of wheel-carriages.

In the year 1779, Oliver Evans, an ingenious American citizen, then apprenticed to a wheelwright, laboured to discover some means other than animal power for propelling land-carriages. He was accidentally made acquainted with the power with which steam is generated from a small quantity of water in the breech end of a gun-barrel, plugged up tight, and placed in a smith's fire. He was fortunate enough to find a book describing the old atmospheric steam-engine, and was astonished to observe that the steam was only used to form a vacuum, instead of being rendered available by its elastic power. Amidst much ridicule, he confirmed his discovery by experiments.

In the year 1786, he petitioned the legislature of Pennsylvania, for the exclusive right to use his improvements in flour-mills, and his steam-waggons in that State. The committee, to whom the petition was referred, heard him very patiently while he described the mill improvements, but his representations concerning steam-waggons made them think him insane. They, however, reported favourably respecting the improvements in the manufacture of flour, and passed an act, granting him the exclusive use of them as prayed for. This was in March, 1787, but no notice is taken of the steam-waggons."

A similar petition having been presented to the legislature of Maryland, that legislature, upon the argument that the grant could injure no one, conferred upon Evans, for a term of fourteen years, after 1787, the exclusive right of making and using steam-waggons in that State.

Although it does not appear that anything more than a good high-pressure fixed engine resulted from his labours, we cannot omit a very striking prediction in the work of this great projector. "And I verily believe," says he, "that the time will come when carriages, propelled by steam, will be in general use, as well for the transportation of passengers as goods, travelling at the rate of fifteen miles an hour, or 300 miles a-day, on good turnpike roads."

In the year 1784, Mr. James Watt, whose wonderful genius, it may be said, *broke in and trained* the steam-engine, took out a patent, amongst other improvements of the steam-engine, for a mode of applying it to wheel-carriages.—*Gordon on Locomotion.*

HOW TO BE RICH.

If the accumulation of riches were the only object of life, this great problem might be solved with little difficulty; " Nothing is more easy " (says Mr. Paulding) " than to grow rich. It is only to trust nobody—to befriend nobody—to get everything, and keep all we get—to stint ourselves and everybody belonging to us

—to be the friend of no man, and have no man for our friend—to heap interest upon interest, cent. upon cent.—to be mean, miserable, and despised, for some twenty, or thirty years, and riches will come as sure as disease and disappointment." Let any man in tolerable circumstances—any working man above absolute indigence, ask himself what are the causes of his troubles aud discontent—for it may be assumed that he is not free from tronble, since we are taught by experience that the common lot of mankind is made up of pleasure and pain—he will find that the want of riches is one of the least impediments to his happiness. Some grieve because they cannot possess the object of their affection, others because they cannot get rid of it; some because they are unjustly censured, others because they are undeserving of their good name; many create imaginary wants, and imaginary evils, and fret because they cannot satisfy the one, or remove the other; but the amount of evils springing directly and solely from the want of riches, is very small indeed. But while we condemn the "*Auri sacra fames*," or ravenous craving for gold, which sacrifices honour, humanity, and consequently all real and durable enjoyment, to the gratification of this one overruling and inordinate desire, it must not be imagined that we recommend the opposite vice, improvidence, dissipation, and neglect of the opportunities which are afforded to almost every man, at some period or other, of bettering his condition. That fortune properly employed, is the great fountain of enjoyment both to its possessor, and to those around him, is so manifest, that its denial can only be attributed to extreme folly or insincerity. There are many honourable and pleasant ways of growing rich to a certain extent; industry, order, and calculation, are seldom found to fail; if a man possesses a sufficient income to allow him to expend ever so little less than that income, without depriving himself of any essential enjoyment, he will not only make provision for future contingencies, but will assuredly enjoy more real pleasure from the tone of tranquillity and independence, which ever accompanies this prudent mode of living, than he would derive from all the pleasures which double the expenditure would enable him to possess. To amass great riches, extraordinary sagacity, or extraordinary fortune, and often both combined, are necessary to the success of an honest man; but when we consider the innumerable patents, schemes, companies, and enterprizes of every conceivable kind, which are no sooner announced and propounded, than a host of rich boobies, eager speculators, and generous friends to improvement, though actuated by various motives, concur and vie with each other, in swelling the golden stream that flows into the coffers of the new "company;"—when we see fortunes springing from a razor-strop, a pill, or from new-fangled nothings, possessing neither merit nor utility, we cannot deny that the power of getting rich is within the means of every one who is in possession of that peculiar talent, or instinct, which enables him to distinguish the most favourable opportunities, and turn every thing he meddles with to his own advantage and profit. But these brilliant and seductive sources of fortune are reserved for a privileged few: in unskilful hands, they yield only disappointment and ruin. After all, if you can only "keep the wolf from the door," riches and poverty have no positive meaning; for in some circles you may hear heart-rending tales of the distress and suffering of poor creatures reduced to five thousand a-year, while in others, a labourer with twelve shillings a week is considered a fortunate and enviable being. Instead of riches, seek for contentment, and you will not be disappointed; for to will it, is to possess it.

METEOROLOGY.—STORM IN BELGIUM.

Extracted from a Letter by M. Quetelet.

On the fourth of this month, at a little after twelve o'clock at noon, a rain commenced, which at first offered nothing remarkable, but became more intense towards eight in the evening. At this period thunder was heard, and the rain became an absolute deluge. In several places the harvest is destroyed, the country inundated, trees rooted up, and houses entirely demolished. A whole village, that of Burgt, near Vilvorde, was destroyed almost in an instant. A torrent was formed with such rapidity, that the inhabitants had not time to escape. Thirty-nine bodies had been found at the time M. Quetelet wrote his letter, and 21 or 22 persons were still missing.

This storm seems to have exercised its ravages particularly in the valley of Woluwe, which extends from Turvueren to Vilvorde. It is believed that a great portion of the damage was occasioned by a water spout. The quantity of water collected on the terrace of the observatory at Brussels in the space of 24 hours (from noon to noon), amounted to 112·78 milli-

metres, an enormous quantity in our climates, since it forms a *sixth* of the whole quantity of water which falls annually at Brussels (675·75 millim.) The rain fallen in the places before mentioned, must have been still more considerable. To form an idea of the extraordinary amount of this rain, it will be sufficient to recite the greatest quantities of water collected at the observatory at Brussels in the space of twenty-four hours during the last six years :—

1833	June 7	50 mil. 27
1834	Aug. 27	30 — 71
1835	Oct. 9	25 — 89
1836	Mar. 14	42 — 01
1837	Aug. 10	26 — 73
1838	June 28	27 — 24

The storm was also felt at Liege, Antwerp, &c. At Alost, near the theatre of the principal disaster, only 54 m. 60 of water fell in 24 hours, from the 4th to the 5th of June. The storm was most violent from nine to 12 o'clock on the night of the 4th, and the greater part of this immense flood, fell between those hours.

AMERICAN LOCOMOTIVE ENGINES.

We learn from the *Midland Counties Herald*, that the Birmingham and Gloucester Railway Company, has contracted with Mr. Norris, of Philadelphia, U. S., for the supply of locomotives for the Gloucester Railway. The following description is given of an engine sent over to this country by Mr. Norris, and tried on the Grand Junction Railway. "The England" weighs about eight tons, without water or fuel; she is built much lower and smaller than the engines commonly in use here; and has six wheels, the driving pair being four feet in diameter, and are inclosed in copper cases to prevent radiation: the stroke is eighteen inches. The machinery is of the simplest construction, and consists of a much smaller number of parts than we have been accustomed to see. The cylinders are placed on the outside of the frame-work, which allows the advantage of a straight axle; and the general appearance of the engine more nearly resembles that of the old "Rocket" engine than any other with which we are acquainted. The engine is got up in a most superior style, and is finished, even to the minutest particular, in a very beautiful and workmanlike manner; every part having been executed with perfect accuracy, by means of self-acting machinery. As a proof, indeed, of the mathematical correctness of the work, we may mention, that the steam-tight joints are formed simply by the bringing into contact of metallic surfaces, the workmanship of which is so true, as entirely to supersede the necessity of packing of any kind. The boiler is similar to those used in engines manufactured in this country; but it contains only 78 tubes instead of 100 to 140, the number commonly used in those on our railways; and the consumption of fuel compared with the work performed, is, we understand, very small. The task undertaken to be performed by "The England," was to run from Birmingham, fourteen journeys each way, carrying 100 tons in the gross, and performing the distance, eighty miles, at the rate of twenty miles per hour, which the engine has accomplished considerably within the specified time of four hours; the average time having been about three hours and fifty minutes, or the actual running time without stoppages, from three hours and nine minutes, to three hours and nineteen minutes. On one occasion, it is stated that the Engine brought into Birmingham the enormous load of 126 tons, drawing it up the inclined planes on the line without any assistance; and on no one occasion has it failed to perform the required duty, nor has ever the least derangement of any part of the machinery taken place. It should also be mentioned that the various parts were *never put together until its arrival in this country*, when they were first fitted at Liverpool, the day previous to making a trip; nor has a tool been applied to the engine since she was first set up. We understand the conditional order sent to Mr. Norris for ten engines of similar capability, has been confirmed." We refrain from any lengthened comment at present, as the account appears to be very inaccurate; but if America pretends to supply England with machinery, and sordid companies assist them in ruining British manufactories, it is high time the legislature interposed its protecting authority.

THE FATAL ACCIDENT ON THE EASTERN COUNTIES RAILWAY.

A very erroneous account of this accident has been spread abroad by many of the daily and weekly newspapers; as we are not of the last, but of the present century, we vindicate the cause of mechanical locomotion, by publishing the following account of the investigation before the Coroner and jury, which clearly shows

that *animate*, and not *inanimate* power, was the cause of the mischief.

CORONER'S INQUEST.

On Saturday an inquest was held at the Yorkshire Grey, Stratford, before C. C. Lewis, Esq., coroner for Essex, on the bodies of John Meadows, engineer, aged 35, and Charles Leech, stoker, about 20, who were killed on the Eastern Counties Railway, on the previous day, by the engine getting off the line, owing to the imprudent speed at which they were driving.

The following details of the proceedings (as furnished by the proprietors of the *Essex Herald*) will show that a very erroneous account of the accident has appeared in several of the journals:—

Henry Tristam examined—I am a sub-engineer on the railway, and was at Romford when the accident occurred. The train started from the Mile-end station at a quarter before five in the afternoon of yesterday, and consisted of an engine, tender, and four or five carriages. John Meadows was in charge of the engine, and Charles Leech was stoker. That is the usual complement of men for an engine. Meadows was an experienced man, and I considered he knew his business very perfectly. They were both sober men. I had seen them at Romford about four, and I spoke to Meadows of the pace he was to go. I cautioned him that he was going at a greater speed than the company allowed. They had a scale by which they were to regulate the speed. I arrived at the spot about half an hour after the accident, and I found the rails bent, and some of the chairs broken. I had inspected the line that morning, as it is my constant habit to do, and the trains had passed over several times that day. The accident occurred in a place which I can conscientiously say was perfect, and the engine and carriages were in perfect order, and going well when I saw them. The rails, I found, after the accident, damaged to the distance of 130 yards. The engine began to damage them half way between the two bridges, and damaged them 70 yards before it got off on the rails on the north side. The action of the engine had driven them southward on both sides. It was a waved line. Some of the chairs along the 70 yards were also broken. After the engine got off the line the rails were damaged, and the chairs broken, then she crossed to the southward, and fell over by catching her wheels in the rails. I found the engine in that state when I arrived, but they were attempting to remove it. It was removed to the side, and the rails put in order for travelling again. I consider the cause of the engine going over was the extreme velocity at which the engineer was driving. I cannot account for it by any other cause than excessive speed.

A Juryman—If they had been going slowly might it have happened?

Witness—If they had been going slowly it would not have happened.

Would not, in consequence of the heat of the weather, the rails dilate and lengthen?—They will lengthen considerably, and we allow the eighth of an inch for it. It will not exceed that at any time.

The rail might rise upwards if it lengthened?—It might, but the engine would press it down.

Mr. Duncan—Mr. Braithwaite, the engineer, made allowance for the expanding and contracting of the rails in hot and cold weather?

Witness—Yes, that was one of the points attended to.

Mr. Hall—Do you know that with the most severe heat in this country the rails would expand more than the eighth of an inch?

Witness—No; extreme heat and extreme frost would not operate more than that.

A juror said he saw one of the rails near the bridge an inch apart.

Witness said that arose from the repairs—they never laid them down so.

Mr. Hall—Would any danger arise from an engine going 40 miles an hour?

Witness—Never.

Mr. Richard Hall examined—I am managing director of the company. I was sent for, and got to the spot about half-an-hour after the accident. I concur in what Mr. Tristam has said of the state of the rails, and I can attribute the accident to no other cause than over-speed. When the train came up before, I stopped the man, and told him I should fine him if he was before his time.

William Woodford—I am a plate-layer in the employ of the company. I was yesterday at work with other men, about 60 yards from where the engine lies now, when I saw the train approaching, and she was coming terribly fast. I have been in the habit of seeing trains pass me constantly, but I never saw one pass so quickly as this. I saw her about half-a-mile off, and I said, "Come away; this engine is coming terribly fast, and I think she will not be apt to get round the curve at that speed." She appeared to be getting

on more steam, and I saw her rocking very much; after the rocking began it increased. The steam was not turned off. After rocking for some way on the rails, she got off about 40 yards from where I stood. The engine dragged the train along the gravel about 50 yards, and then broke loose; it ran about 10 yards, then struck and fell over. The carriages went all by the engine on the gravel, the force with which they were being dragged sent them past; the train went 100 yards on the gravel. The off wheels of the carriages ran between the south side of the rails; the engine itself had got over on to the south side.

A Juryman—Did you see the engineer on the platform in his proper place at the time?

Witness—I saw him standing at the regular place. When they passed me they were both holding on—they were both on the engine. I have never seen them holding on when going a moderate pace. I saw them on the engine at the time it broke away.

A Juryman—What killed the men, the engine or the carriages?

Witness—I should suppose that the carriages killed them; but I cannot say. Meadows, when found, was lying under the engine, but not under the wheel. I was up to him in half-a-minute, but he was quite dead. Leech I found underneath the last carriage wheel—he was quite dead. They were lying on the left of the engine, which had gone over to the right. Being thrown on his head from the engine might have caused Meadows's death.

The Coroner—What pace do you think they were going at the time you saw them?

Witness—A mile a minute; that is 60 miles an hour.

A Juryman—Was it possible for the engine to go 60 miles an hour?

Mr. Hall—It is great spe· for a train to go at, but an engine would go 100 miles an hour.

Mr. Hall said Mr. Braithwaite's brother was present (Mr. Braithwaite being from home), and wished to state the orders that had been given.

The Coroner thought it was hardly necessary, and he added, "I am perfectly satisfied that every precaution had been taken by the Company."

The gentlemen connected with the Company, however, were anxious that he should be examined.

Mr. F. Braithwaite was then sworn, and his evidence proved that the accident was caused through over-speed.

The Coroner then briefly summed up, and said he thought it was clear that the accident happened from the speed with which Meadows was driving; no possible blame could be attributed to anybody but himself, for every precaution had been taken by the Company to preserve order, and protect the lives of parties on the train.

The jury accordingly returned a verdict of "Accidental Death," and the foreman added, "We wish to state that we are perfectly satisfied with the conduct of Mr. Braithwaite and the Company throughout, and we consider it was purely from the imprudence of the driver that the accident occurred."

ON SPRITUOUS DRINKS.

(From the *British Cyclopædia.)*

THE effects of fermented liquor on the animal economy, arises principally from its *stimulating* power, or the power which it possesses of exciting the muscular parts to an increased rapidity and strength of action, as well as the nervous and mental qualities, to an unusual degree of acuteness. When the animal functions are carried on with languor and feebleness, from whatever cause, the general sensations of the body are uneasiness, sometimes to a degree of pain. Thus, after long fasting, want of sleep, fatigue, or disease, this condition of the frame exists, and prompts us instinctively to the employment of some stimulus, as food, tepid or fermented drink, the warm bath, &c. The immediate effect of such stimula, especially of fermented liquors, is the diffusion of a grateful sensation throughout the body; the languor and listlessness of the previous state are superseded by a general pleasurable feeling of warmth, energy, and self-command, accompanied by an indescribable tranquillity and complacency of mind; the countenance is enlivened with a glow of animation, in consequence of the free circulation through the cutaneous blood-vessels, and the renewed energy of the muscular parts, which were before languid and relaxed. From the same moderate excitement of the circulation and nervous system, the flow of animal spirits becomes more free and spontaneous, giving birth to lively conversation, to the flow of eloquence, and the sallies of wit: anxieties and corroding cares, respecting the business of life, are laid aside for the time, and good humour and cheerfulness prevail. With those who are habitually temperate, this degree of excitement, both mental and corporeal, is

the result of a very moderate stimulus; taking food alone is adequate to produce it, with little aid from fermented liquors. This is the excitement of nature, is consistent with, and conducive to, the healthy operations of the constitution, and contributes to cherish the flame of life to its latest spark. But

—— "Know whate'er
Beyond this natural fervor hurries on
The sanguine tide; whether the frequent bowl,
High-season'd fare, or exercise to toil
Protracted, spurs to its last stage-tired life,
And sows the temples with untimely snow."
ARMSTRONG.

If the heating draught is continued beyond this moderate excitement, the increasing effects of the stimulation become obvious. The circulation is farther quickened and strengthened, so that the whole surface glows with redness and warmth; the face is flushed, the eyes, which were at first bright, become suffused with a degree of redness, from the blood being carried into the smaller vessels, which are ordinarily transparent with lymph only. The muscles acquire a greater power of action, and a greater propensity to exertion ensues, whether to dancing, wrestling, or to whimsical gesticulations: and the mental faculties are in a similar manner roused. Cheerfulness arises to boisterous mirth; noise and ribaldry, passing with rapidity from subject to subject, succeed to the eloquence of rational conversation and chaste wit; the song becomes louder, and excessive laughter marks the high excitement of the mind. The passions and dispositions are also elevated beyond their natural pitch. "In the bottle," as Dr. Johnson observes, "discontent seeks for comfort, cowardice for courage, and bashfulness for confidence." In a word, the whole man, mind, and body, is elevated by the use of vinous liquors, in all his qualities and functions, far above the accustomed powers naturally inherent in his constitution.

This state of inordinate excitement manifests itself in various ways, in different individuals, and also under the influence of different species of liquor. Thus, intoxication from drinking porter, or other malt liquors, which contain the narcotic substance of the hop, or other vegetables, together with much mucilaginous matter, and require to be drank in large quantities, is generally accompanied with more of stupor than the inebriation occasioned by distilled spirits; and the same may be said of the heavier wines, as compared with the lighter, or those which contain carbonic acid gas. But the variety of the symptoms of drunkenness depends much more on the natural disposition, and on the corporal temperament of the individual, than on the species of the intoxicating liquors. We thus see some in their cups, mild and gentle; while others are fierce and implacable: this one is complaisant to his enemy, and forgetful of injury; that is insulting to his friend, and thoughtful of revenge. This person is gay and loquacious; that one is dull, sullen, and silent; and a third is turbulent and loud, making the place of his orgies echo with oaths and imprecations. As in other species of insanity, the inebriated feel not the blush of shame, and the habitual drunkard degrades himself below the brute which he imitates.

REVIEW.

The Book of Experiments, illustrating principal Facts and curious Phenomena of Electricity, Galvanism, Magnetism, Chemistry, Optics, Heat, &c., with Introductory Observations on each Science, and upwards of 300 *Experiments.* By J. S. DALTON. London: Darton and Clark, Holborn Hill.

THIS work, to say the least of it, fully realizes the expectations which must naturally be excited by the announcement of a treatise on subjects so universally interesting, and calculated to impart so much valuable information combined with the most rational and agreeable amusement. The author has taken a wide field, and he has well cultivated it. He proposes his book chiefly for the instruction and entertainment of youth; but there are very, very few persons "grown to man's estate," who would not become wiser after reading and studying this volume. "A little learning" is not a dangerous, but a good and valuable thing, and those who desire to be acquainted with natural philosophy, without devoting a considerable portion of their time to deep study, will find an excellent guide in the "Book of Experiments." The style is easy and clear, and well calculated for the study of youth, without being in any degree childish, as is too often the case, where lucid simplicity should be the only object in deviating from the more abstruce and technical forms of science. The author has, with our consent, availed himself of many articles which have appeared in the "Mechanic and Chemist," and we return the compliment by presenting our readers with some extracts from the "Book of Experiments," which we trust will be found not only interesting in themselves,

but promote the circulation of a work of more than ordinary merit. The following is from the introduction to chemical experiments:—

"The first important fact to be noticed is, that *when two substances combine, the compound they form is always different in its nature to themselves.* Two bodies, decidedly poisonous, when combined chemically, may produce a compound, not merely uninjurious, but even necessary to our existence! This fact is strikingly illustrated in the combinations of the two elements called oxygen and nitrogen. For example?—

The Atmosphere is a compound of	Nitrogen 4	Oxygen 1.
Nitrous Oxide (laughing gas)	Nitrogen 2	Oxygen 1.
Nitric Acid (aquafortis)	Nitrogen 2	Oxygen 5.

Thus it will be seen, that the same elements which, when mixed together in the proportions first mentioned, produce the air we breathe, form one of the most active and destructive poisons, when combined in the quantities necessary to produce nitric acid; for this acid and the air, it will be seen, are both formed from the same elements, only the proportions in which they are combined are different. In the combinations of the element called carbon, or charcoal, we have another striking example of the different forms one substance can assume. Who would believe that a brilliant diamond and a piece of common charcoal, are the same material, only in different forms? Yet such is the case; and the chemist has the power, by exposing the diamond to a great heat in oxygen gas, of reducing it to the state of charcoal. This circumstance may appear very extraordinary, but it is not more wonderful than that a piece of lump sugar may be converted into carbon. We have shown, in the experiments which follow (Exp. 115), the means by which this can be accomplished; and it is, therefore, unnecessary to allude to it more particularly.

A familiar example of the fact that two bodies, actively poisonous in their natural state, may produce a substance, when combined, that shall be perfectly innoxious, is seen in our common table salt. This is composed of muriatic acid and soda. The muriatic acid, taken internally, causes much agony, and ultimate death; and the caustic alkali (the soda), would produce effects very similar; yet when combined together, they produce a substance ranking amongst the first necessaries of life; for, without common salt, it would be almost impossible to maintain health. As an example of poisons being produced from the combination of substances, which, in their natural state, are not injurious, we may instance the poisons which are formed by animals and vegetables. The dreaded worali—the poison used by the Indians—and the pestiferous and destructive upas, which is produced from the tree of that name, and to the influence of either of which animals cannot be exposed without the loss of life, are formed from the same elements as those which produce the luxurious fruits, and the wonderful variety of beautiful flowers that exist in the countries where these poisons are found. In like manner, the elementary substances that form the flesh of the deer and oxen, upon which man finds subsistence, are the same as those from which the deadly poison of the rattlesnake is produced, or the no less dreaded virus of canine animals in a state of hydrophobia. Thus it will be seen how nature, out of a few simple elements, is able to produce such a wonderful variety of substances, whether the result of organization, or produced from the mineral kingdom."

The experiments are illustrated by numerous wood cuts, specimens of which are given in our front page:—

The Electric Spark.—"When the knuckle is presented to the prime conductor of an electrical machine, or to the edge of the metal plate of the electrophorus, after they have been charged with electricity, a spark is given out, and a sharp cracking noise is heard. The spark is of a blueish colour in the atmosphere, in its ordinary state; but in a glass vessel, containing condensed air, it is white; in rarified air, it is of a reddish tinge; and in a good vacuum, under a receiver, it is of a purple hue, very faintly visible. When the spark is very long, it presents the appearance represented in fig. 1, if viewed in a dark room. The electric spark is supposed to be occasioned by the sudden compression of the air, which occasions a degree of heat sufficient to inflame spirits of wine; but some substances cannot be ignited by it, until it has passed *through water*, when the effect can be produced.

"The light and noise which follow the discharge of an electrified body, is an illustration of thunder and lightning. When, however, electricity is given off from sharp points, it is not accompanied by noise, and has the appearance represented in fig. 2."

The Magic Lantern.—"This well-known and pleasing philosophical toy is so great a favourite, that it requires no recommendation to introduce it to the notice of the student in optics. Its principle will be best understood from the engraving, fig. 3, front page, showing the form of the instrument, and the situation of the lenses employed. These lenses are set in a tube, which can be lengthened or shortened at pleasure, in order to adjust the image of the object on the wall, or other surface on which it is projected. Probably, by the assistance of the woodcut, some of our readers may be enabled to construct a magic lantern; and the pleasure to be derived from it will amply recompense a little trouble. To use it, it is advisable to hang up a table-cloth, or sheet, on a line at a little distance from the wall of a room, and for the exhibitor to stand behind it, as by this means he can increase or diminish the size of the objects at pleasure, by adjusting the tube, and standing near, or at a distance from the cloth. Grotesque figures, animals, &c., painted on glass slides, having the other parts covered with black varnish, to prevent the transmission of light, except through the figure, are generally used to exhibit the powers of the magic lantern, and may be made with a little ingenuity, or purchased at the optician's, where the lenses may also be obtained. Their situation will be seen from the cut."

Besides the explanatory figures, there are beautifully-executed vignettes introduced, a specimen of which is given in fig. 4. It is introduced at the conclusion of the experiments on electricity, and displays the effect of that incomprehensible fluid in the most direful energy of its action. We conclude with an extract from the introduction, in which the author explains his object and intentions:—

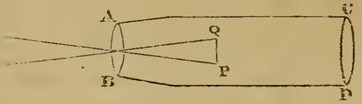
"As the "Book of Experiments" is intended chiefly for the amusement and instruction of young persons, it will not be expected to contain any elaborate views of science. It has been the endeavour of the Editor to collect and arrange only such experiments as might easily be understood, and such as explain, in a pleasing manner, the principles of many of the phenomena of daily life. Some of the illustrations are derived from sources not easily accessible; others are those which the most eminent scientific lecturers of the present day are in the habit of employing; and the remainder, it is believed, have never before been published. The whole are simple and striking, and will, it is hoped, have the effect of stimulating the minds of those who practise them to become still better acquainted with "divine philosophy;" and, by observing the beautiful harmony that pervades the whole material universe,

'Look through nature up to Nature's God.'"

And where else can true philosophy lead? All human knowledge of the mysteries of Nature is derived from observation and experience; of the essential nature of things, we are utterly ignorant. No effort of the human mind could discover (*à priori*) either animal or vegetable life, or any of the phenomena upon which natural philosophy is founded. When we attempt to penetrate the cause of the wonders with which we are surrounded, we approach that dark recess of Nature, which the light of philosophy can never explore; analogies must be assumed as data, and conjectures as demonstrations; imagination usurps the majesty of reason, and the bewildered mind is lost in the vain contemplation of that inscrutible chain of events, which can only terminate in the unknown but Almighty source of all existence.

SOLAR MICROSCOPE.

The solar microscope is constructed in the following manner. Allow me here to remark, that it is copied from a valuable book in my possession. In the inside of a tube is placed a convex lens, A B, and at



a distance a little greater than its focal length, but less than double of it, is fixed some transparent coloured object, Q P, at the focus conjugate to the place of the object. A broad lens, C D, is placed before the object to collect the solar rays, for the purpose of illuminating it more strongly, and, consequently, making the image more distinct and vivid.

W. M. B—r.

Timber required for a Ship of the Line.—A regular 74-gun ship requires 3000 oaks to build her. These trees would cover 100 acres of land for their growth, and would be nearly 100 years in coming to perfection. 3000 oaks would timber 1000 cottages for as many industrious families, who add to the national wealth.*

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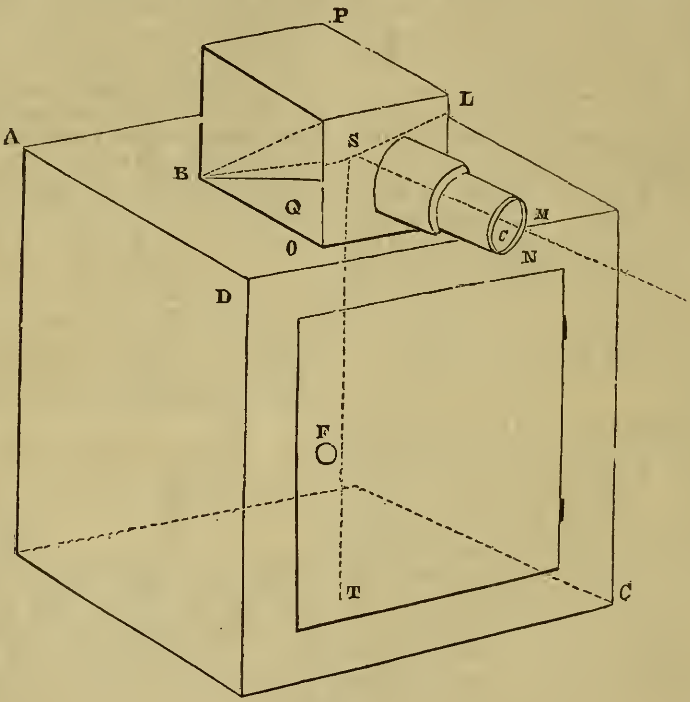
* If we had no ships, we should have no national wealth to add to.—Ed.

TO CONSTRUCT A CAMERA OBSCURA.

To the Editor of the Mechanic and Chemist.

Sir,—" G. Nash," wishes to know the best manner of constructing a camera obscura for the Daguerrotype. Perhaps the following description of one I am now constructing for that purpose, may serve as a slight alleviation of the suspence in which he and many more are anxiously waiting for the development of M. Daguerre's secrets:—A C represents a box about a foot square, shut at every side, except at D C; O P is a smaller box, placed on the top of the greater; M N, is a double convex lens, whose axis makes an angle of 45 degrees with B L, a plane mirror, fixed in the box O P. The focal length of the lens is nearly equal to C S, S T. The lens being turned towards the prospect, would form a picture of it nearly at its focus, but the rays being intercepted by the mirror, will form the picture as far before the surface, as the focus is behind it; that is, at the bottom of the larger box, a communication being made between the boxes by the vacant space Q O. The door, D C, is to be opened, and the prepared paper to be laid at the bottom of the box, after which it is fastened by the turnbuckle, F, so as to exclude all light, except that transmitted by the mirror, S.

Langstaff.



THE CHEMIST.

BISMUTH AND ITS COMPOUNDS.

To the Editor of the Mechanic and Chemist.

Sir,—This metal, although well known to the ancients, was mistaken by them very often for tin and lead; that such a mistake could have occurred, seems almost impossible, as it is very distinct from either of those metals both in appearance and properties, except its low degree of fusibility. But when we look around us, and consider the vast improvements and new discoveries which are almost daily taking place, and more especially in the science of chemistry, we can no longer call such a mistake impossible at so remote a period as the time of the ancients. It was not known as a distinct metal until the fifteenth century, at which time it was described by Agricola. This metal is generally found native, from which the bismuth of commerce is obtained; but it is

also found in the state of an oxide, a sulphuret, and an arsenuret. The common bismuth of the shops is generally very impure, being often contaminated with copper, iron, and sulphur. The pure metal may be obtained by heating the oxide to redness with charcoal. It is a very brittle metal, of a reddish white colour, and crystallizes on being slowly cooled. Its specific gravity, according to Brisson, is 2.822, and its atomic weight 71; its point of fusibility is 476°. A mixture of eight parts of bismuth, five of lead, and three of tin, forms the fusible alloy of Newton, which becomes fluid at about 204°; if to this alloy you add two parts of mercury, it will then become fluid at 176°. The alloy thus formed is brittle, and perfectly white; the red tint of the bismuth being entirely destroyed. Spoons, &c., are sometimes made of this alloy, which, on being put into tea and other hot fluids, immediately fuse and run to the bottom, causing great wonder and astonishment to persons unacquainted with the phenomena. Bismuth is not so good a conductor of heat as most metals; it is not dissolved by sulphuric or hydrochloric acids, but it is readily dissolved by nitric acid, forming a nitrate of bismuth: the solution by slow evaporation crystallizes. The only oxide of bismuth of importance, is the protoxide, which may be prepared by heating to redness the nitrate of bismuth in crystals, the nitric acid is expelled, and the protoxide, which is the base of all the salts of bismuth, is left. It is of a yellow colour, and fuses at a red heat; it unites with, I believe, all acids, forming salts, which are generally white. When the nitrate of bismuth is thrown into water, a copious precipitate of a beautifully white colour subsides; this powder used to be called the magistery of bismuth. It was considered by most chemists to be an oxide of bismuth, but since then it has been proved to be a subnitrate of bismuth. On account of its whiteness, it is sometimes sold as the pearl-cosmetic, so much used by ladies to improve the complexion; but the fraud is soon detected by the sulphureted hydrogen, which turns it from white to a brownish black; it has, indeed, proved too true a test, for many ladies have been made to look very ridiculous by their clear white skin, so much admired, suddenly turning almost black, where sulphureted hydrogen has been present, which is very often the case. Oxygen also combines with bismuth in the proportion of three of oxygen to one of metal, forming a peroxide. As it is of little use, I shall say but little about it; it is a very heavy powder, of a dark brown colour, not unlike peroxide of lead. It does not combine with acids or alkalies to form salts; when heated it dives off oxyden gas, and is converted into the protoxide.

Chlorine combines with bismuth, with heat, and light, in a similar manner to which it combines with antimony, forming a chloride of bismuth; it may also be prepared by heating two parts of bichloride of mercury (corrosive sublimate) with one part of powdered metallic bismuth. It is of a greyish white colour, and opaque; it fuses at a little below the fusing point of the metal itself. It was formerly called butter of bismuth.

The sulphuret of bismuth, as before mentioned, is found native, but it may be prepared by fusing the metal with sulphur; it is also formed when sulphureted hydrogen comes in contact with any of the salts of bismuth. Its colour is lead grey; it as a strong metallic lustre. The tests for the detection of this metal are as under.

1st. A solution of gall nuts causes a dirty white precipitate, but antimony is precipitated by gall nuts in a very similar manner, which I had occasion to speak of in my paper on the tests for antimony; it therefore cannot be considered a sure test for either of those metals.

2nd. Ferro cyenate of potass throws down a precipitate of a pale yellow colour.

3rd. Sulphureted hydrogen causes a brownish black precipitate; this is a sure test for its presence, even in a very small quantity; it might probably be taken for sulphuret of lead; but if you add sulphuric acid to a solution of bismuth, no precipitate will take place, the sulphate of bismuth being soluble; but, on the contrary, with lead, a dense white precipitate would be the result, the sulphate of lead being quite insoluble; but the precipitation of the subnitrate by water, is a sure sign of its presence, being a character quite distinct from any other metal; this, however, can only be tried on the nitrate o the metal.

A. Taylor.

ELECTRICITY.

NO. VI.

(Continued from page 214.)

Before speaking of the experiment on water I last mentioned, I shall give other instances of the synthetic, or composing powers of electricity, as shown by the common machine.

29. Mix a little oxygen gas with twice its bulk of hydrogen: introduce about a cubic inch of this into a strong glass tube, (one-eighth of an inch thick, and five-eights diameter, will do), having a cork firmly fitted into one end, with two wires passing through it, and the ends coming within one-eighth of an inch of each other, in the gas, a spark, or slight shock, sent through the wires, will inflame the gas, when an explosion ensues, and the tube is lined with a vapour, which is pure water, being the only product of the experiment; the tube then contains a perfect vacuum, which may be seen by opening the mouth of the tube under water, or any other fluid, when it will be instantly filled.

30. If hydrogen be mixed with laughing gas (nitrous oxide), or atmospheric air, when a spark is passed through it explosion occurs, with the formation of water, but some nitrogen gas will then remain in the tube. Explosions may be produced with several other gaseous mixtures, besides the above-mentioned, by the electric agency.

Having shown the mode of composing water from its elements, I shall now describe the method of decomposing it, or re-separating it into its component parts, by the common electrical machine. It is much better done by the voltaic battery, but that method I shall leave until I speak of voltaic electricity. The means of effecting it by the machine was invented by that inimitable philosopher in microscopic chemistry, Dr. Wollaston. It is done in the following manner:—

31. Thrust a very fine gold wire through a piece of thermometer tube, and fuse the tube, so as to seal the wire in it through its whole length; then grind away one end of the tube, until the point of the wire is exposed. Two of these tubes are to be partly immersed in water, with the ground ends downwards, and brought as near each other as possible: a tube is placed above them to receive the gas as it is formed. The upper ends of the wire are then to be connected one with each conductor of the machine, upon turning which a current of sparks passes from one wire to the other, and decomposes the water in its progress.

The last division of the effects of electricity is its physiological effects. It has been supposed that the application of electricity, either in the form of the spark or shock given by the common frictional machine, or the voltaic battery, would prove a most important auxiliary to the materia medica; and many authors have given lists of the diseases it was supposed to have cured. But although it may be beneficial in some of these, the general opinion of the medical profession now seems, that its powers are far more limited than they were formerly supposed to be. But it is to be regretted that (at least as far as I have heard) it has not been tried in the systematic manner which appears necessary for its successful application. It has been said by some medical writers, to have relieved or cured chronic rheumatism, by insulating the patient—seating him on a glass-legged chair, and taking a current of sparks from the part affected for a quarter of an hour per day for some weeks; and deafness, by acting in the same way, and taking the sparks from the tympanum of the ear. I have myself frequently been relieved of a pain in my forehead by passing slight shocks through it, holding the jar in my hand, and applying the ball to the part affected. I have sometimes imagined that when the jar was charged negatively it had the most beneficial effect, but whether this was really the case or not I will not pretend to say. I will now detail some experiments on its effects when administered to various parts of the body.

32. Pass a moderate charge through the diaphragm, by holding the jar in one hand, and applying the knob under the stomach, a loud shout will be caused, quite involuntary.

33. If a charge be passed through the back in the same manner as the last, a violent laughter is excited.

34. If a strong charge be passed through the spine, the person feels extremely weakened, and generally falls from exhaustion.

35. When a charge is sent through the head, if very strong, a temporary loss of memory is produced. Mr. Singer, the author of an excellent elementary work on this science, states that he once accidentally received the charge of a battery through his head; the result was as I have just stated, a temporary loss of memory, indistinctness of vision, and (if I remember right) a ringing in the ears, and violent pain in the head, which lasted for some hours. I should not advise any person to try this dangerous experiment, for I think, that to persons of the nervous temperament in particular, it is not improbable that permanent injury might be caused.

36. Tie a rat, kitten, mouse, or other small animal on the table of the universal discharger, put the wires into its ears, and send a strong charge, by this means, through the head of the animal; instan-

taneous death will be the consequence. It would be a barbarous experiment to try, but I have no doubt that if a shock were passed through the eyes, or any other means were used to bring the optic nerves into the circuit, that blindness would be the result. It was, without doubt, by some method of this kind, that Van Marum succeeded in blinding turkeys.

37. A much less cruel experiment than that I have just mentioned, and at the same time a highly amusing one, is to pass a slight shock through the body of a cat or dog (the cat is preferable), by holding its tail in contact with the outside of the jar, and touching its nose with the knob. Cats are mostly sagacious enough to know the powers of the Leyden jar after a few repetitions of this trial.

I have now spoken of the principal effects of electricity, both luminous, chemical, mechanical, and physiological, as exhibited by the common cylinder electrical machine. I shall next notice some other means of exhibiting the same phenomena. ELECTRON.

Sinking of Buildings.—On the morning of Sunday week, it was discovered that a building in the New Town, Whitehaven, had given way, but so little attention appears to have been paid to the matter, that the occurrence did not become generally known in the town for some days. However, as the sinking was afterwards ascertained not to be confined to one building, alarm was naturally created, which increased as the occurrence gained publicity, inasmuch as the consequences and danger were magnified every time the story was turned over. In the course of two or three days from that time, the rents in the different buildings affected increased considerably, but since then, some of them, at least, have gradually closed, and hence the supposition is, that the vacuum, the original cause of the accident, has been completely filled up by the superincumbent earth, and that no further danger need be apprehended. We need hardly observe that this startling occurrence was attributed to the present working of the coal mines, but on examination, the opinion was ascertained to be entirely erroneous. It is probable that the void, which has occasioned the shrinking, is some unknown workings nearer the surface; and as it has been discovered in different parts of the ground in that neighbourhood, that small seams had been worked, perhaps two or three hundred years ago, but of which no plans were kept, it appears more than probable that the giving way under notice has been occasioned by the falling in of the roof of one of these drifts. Some of the inmates of the houses which have given way were so much alarmed, that they quitted their apartments on Saturday, but as the alarm subsides, and there is now no fear of further damage, they will probably return again in a few days to their abandoned homes.—*Carlisle Patriot.*

The Earthquake in Lancashire.—It appears from the accounts which we have received, that the earthquake on Tuesday morning was experienced along a line running from south to north, along the westerly side of the hills which separate Yorkshire and Lancashire. The most northerly point at which we have heard of it, is the neighbourhood of Clitheroe, where it caused considerable alarm, especially amongst the inhabitants of the small villages near the foot of Pendle Hill. Its effects were experienced at Bacup, Rawtenstall, Blackburn, Haslingden, Edenfield, Bury, Rochdale, and Manchester; but we do not learn that it was felt at Oldham, or Ashton-under-Lyne, which, from the situation of those places, we should have expected. Throughout the whole range of its operation, it was attended by a hollow rumbling sound, and many persons who, from being in motion at the time, were not conscious of the shock, had their attention forcibly arrested by the very peculiar noise which attended it. So far as we have been able to collect, the shock was more violent at Bury, Rochdale, and Heywood, than in any other quarter, and it there caused very considerable alarm to many persons. At Heywood, the shafting in the workshop of Mr. Mills, machine-maker, was thrown out of geer by the vibration, and a quantity of china was broken in a closet at the residence of Mr. W. Morton; at Rochdale, the wall of a building was slightly damaged; and at Bury, many articles in different houses were displaced and thrown down from shelves and chimney-pieces. Lofty buildings, such as cotton factories, were in many places rather violently shaken, and in some cases the hands rushed out, supposing that the building was falling, or that some very serious accident had occurred. We cannot learn that the shock extended to the westward in a line from Manchester to Blackburn, and we therefore infer, that if felt at all in that direction, it must have been extremely slight.—*Manchester Guardian.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, July 3, B. Seare, Esq., on the Writings of Charles Dickens. At half-past eight o'clock precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday July 4, Wm. Basham, M.D., on the Nature of the Evidence in cases by Poisoning. At half-past eight o'clock.

QUERIES.

Which is the best method to melt black antimony, and to flux it and separate it from the sulphur, so as to leave nothing but pure metal? Also, which is the best method to harden steel for magnets? Also, how to cast zinc plates and rods for galvanic batteries; or to inform me if I can buy them ready cast? TYRO.

What are the principles of that department of art called zincography, and what the essentials for its successful practice? TENEFELDER.

[Our correspondent probably alludes to a recent invention (for which a patent was obtained)

of a process for substituting metal plates for wood engravings. The design is traced with a varnish, which resists the action of an acid which is afterwards applied, and eats away all the surface, except the parts required to be left prominent.]

How to render sulphur, when melted, so fluid that only a thin coat will remain on the ends of matches when dipt? AN ECONOMIST.

What pressure should I have on a boiler, by placing a half-pound weight on the lever of a safety-valve, at the separate distances of 1, 2, 3, 4, 5, 6 inches from the spindle of valve, the hole through which is one fourth of an inch, and the distance from spindle to fulcrum one inch? What pressure of steam is a boiler capable of bearing, made of sheet copper one-twenty-fourth of an inch thick. It is a cylindrical boiler, one foot long, six inches diameter, with flat heads soldered on? What are the substances used in voltaic pot batteries, to cause the electricity? Can you inform me of any rule for reckoning the power of small models of steam-engines, as I find it a great difficulty? What is the principle of the screw by which the Archimedes steam-boat is propelled, and how does it act? W. H. C.

Any person having the three first volumes of "The Mechanic and Chemist," to dispose of at a reduced price, may find a purchaser by addressing to N. P. R., at the office, City Press.

1. How to make fluoric acid? 2. How to make sulphate of soda? 3. How to make yellow fire? 4. How to take a cast of a person's face, so as to take a cast from that again? 5. A description of Woulf's apparatus, such as is used for making chlorate of potass.

Pimlico. F. JONES.

The best adhesive substance for fastening tinfoil to the wooden cylinder of an electric machine, and the best way of so doing to get the surface free from blemishes? J. P.

1. How to set out the teeth of wheels? 2. Whether the teeth are cast with the wheel, or cut afterwards? 3. Where metal tubing can be bought fit for models of steam-engines? 4. What sort of sand the founders use? 5. How to construct the anti-friction wheels? 6. Whether the crank of a steam-engine is cast or wrought?

A YOUNG ENGINEER.

How is lithographic tracing-paper made?

A SUBSCRIBER.

How to make and use an electrometer, an electrical battery, and an universal discharger? Also, how to make a cement to join iron that it will be fire proof? A. M. B. R.

The method of taking grease out of printed paper? Of hardening steel without warping? Of making Petersham cloth water-proof? Of making naptha to burn in a lamp? And composition to fill decayed teeth? ROBERT.

Can any of your intelligent readers inform me the title and author of the best treatise on the measurement of different trades connected with building? Also, if there is any any treatise published on estimating builder's work? And further, if they know any individual disposed to give a few lessons on those subjects? T. B.

TO CORRESPONDENTS.

Corporal Yates' *algebraical solution shall appear next week.*

J. A. S. *shall be attended to.*

P. Truman *will find his queries answered next week.*

N. B.—*Drill small holes in the shell according to the required figure, and stop them with silver wire made taper at the end; be careful to put the pins in from the side to be exposed. If the shell is thin they should be riveted.*

J. S.—*His advice is doubtless very good, and we regret that we cannot insert his letter; but the details of medical treatment are not only uninteresting, but unpleasant to those they do not concern; and it is a subject that does not come within the intention of this work.*

A. Z. *May see a letter on the subject of his inquiry, by applying at the office, City Press.*

A Subscriber.—*It is not, and cannot be our desire to disoblige our friends; but our correspondent will perceive by referring to what is above stated, that we wish to avoid the subject to which his query relates; we nevertheless insert it, and will do the same with any rational answer:— "What is the best remedy for a sore throat?"*

J. M., junior, *shall be answered next week.*

Melek Ric (Brighton).—*His queries shall be answered or inserted. He states, that the first stone of the viaduct on the London and Brighton Railway has recently been laid with masonic honours, and he wishes us to give a history of the society of Free Masons*:—Nous nous en garderions bien.

We are compelled to defer till next week the answers to several of our correspondents; but they shall not be forgotten.

On the 1st of July, 1839, will be Published (to be completed in Twenty Monthly Numbers), price 6d.,

WILL'S WHIM; consisting of Characteristic Curiosities, with Original Anecdotes of Men and Things. Illustrated by Jacob Parallel, Esq.

PLAN OF THE WORK.

Every Number will exhibit the Virtues, Vices, or Follies, of Human Life, as they every day appear, in their most amiable, most subtle, or most eccentric forms. Of such characters, however, those only will be selected as, it is presumed, will afford a pleasing interest in the perusal of their actions, from their respective peculiarities in attaining their favourite objects.

In addition to our other details, we shall occasionally diverge into the very depths of drollery of every denomination. The not unfrequent comic tragedies of real life, the burlesque of intuitive discovery, the epicurean sentimentalities of modern refinement, are all fair game for the goose quill; and in pursuit of which, while we hope to prove ourselves good marksmen, we will only premise here, that it shall be our special aim never to overshoot the mark.

With each Number will be given, in addition to our illustrations of comicalities, cut in wood, an elegant Steel Engraving.

We shall sedulously persevere in our self-imposed task, until "Will's Whim" shall constitute a handsome octavo volume; and which, when completed, is intended to be the most amusing record of exemplification extant.

London: G. Berger, Holywell-street, Strand; and D. A. Doudney, 1, Long-lane, Smithfield.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand: and may be had of all Booksellers and Newsmen in Town and Country.

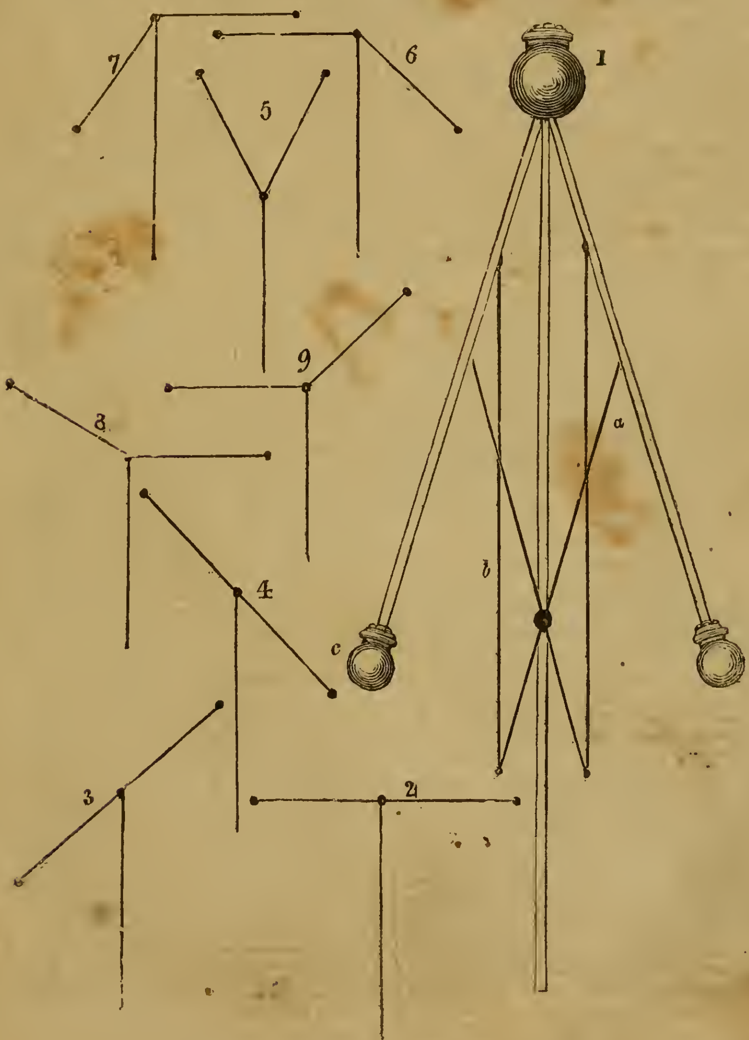
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXII. NEW SERIES. | SATURDAY, JULY 6, 1839. PRICE ONE PENNY. | No. CLIII. OLD SERIES.

JENNINGS'S NIGHT TELEGRAPH.



City Press, 1. Long Lane, Aldersgate Street : D. A. Doudney.

JENNINGS'S NIGHT TELEGRAPH.

(See Engraving, front page.)

This ingenious invention is brought forward very opportunely, as the Lords of the Admiralty are now engaged in the examination of different plans for preventing the collision of vessels, especially steamers, in the night. The silver Isis medal has been awarded by the Society of Arts, and H. R. H. the Duke of Sussex, on presenting the medal to Mr. Jennings, took occasion to express his very high approbation of the principle which is calculated for universal adoption in all parts of the world.

Mr. Bray, ironmonger, 264, Strand, is appointed to manufacture them, and models may be seen at the Society of Arts in the Adelphi, and at the Adelaide Gallery.

Description of Engraving.—Fig. 1, *a*, a lever raises *b*, which operates upon the red light *c*, and so *vice versa*. [It is secured in its various positions simply by a pin.] It denotes the vessel is stopping, or at anchor; the centre light is white, the right hand, or starboard light, red; the larboard light blue. These lights are very powerful bull's eyes, and are calculated to be seen at the distance of one mile.—Fig. 2, the three lights in a line horizontally; helm steady. Fig. 3, the blue light elevated, and the red depressed; helm port. Fig. 4, the red light elevates, and the blue depressed; helm starboard. Figs. 5, 6, 7, 8, 9, the red and blue lights elevated, the white light depressed. Signal for pilot, or in distress, any given signal may be agreed upon.

ARTESIAN WELLS.

The Artesian well, which is now in progress of boring, at the *Abattoir de Grenelle*, is now sunk to the depth of 466 metres, and no water has yet been obtained. For some time past they have been working through white chalk, but have now passed into a bed of green chalk. This kind of chalk offers much less resistance than the white, and it is expected that they will now continue to pierce a metre per day.

M. Mullet has communicated to M. Arago some details relative to a well which he has recently bored at Tours. He descended to the depth of 212 metres, when a jet was obtained which supplied four thousand litres of water per minute, at the height of half a metre from the surface of the earth. This immense quantity of water has suggested the idea of employing it as a motive force; with this intention, the tube has been raised to the height of six feet above the surface of the earth. At this height the quantity of water supplied is reduced to 1800 litres; but it is still sufficient to work the machinery required in a silk manufactory. When the machinery is not in action, the water flows from the first orifice, giving out 4000 litres per minute; but several wells in the neighbourhood are affected, and supply less water than when the upper orifice is used.

CHEAP POSTAGE IN FRANCE.

After the unequivocal declaration of the British government of their determination to give full effect to the universally-desired measure of uniform penny postage throughout this country, it becomes unnecessary further to urge its expediency, advantage, and, if the unanimous voice of the nation be responded to, its absolute necessity. Great preparations will, no doubt, be required, in order to enable the different post-offices to provide for the dispatch of business, which it is anticipated will be enormously increased, and ample time is allowed to make every necessary arrangement, and to prepare for every contingency that can be forseseen; but if any neglect on the part of the legislature, or dawdling in the administration of the post office, should delay the operation of the promised system beyond the appointed time, viz., 1st of January, 1840, that delay will not only create much disappointment and discontent, but not improbably deprive this country of the glory of first adopting a measure which promises, in its ultimate consequences, to promote in the highest degree the well-being of the people, cement the jarring elements of society, and by enlightening deluded men, and enabling them to receive the disinterested advice of those who possess superior knowledge or experience, strike a more deadly blow at civil discord, than the severest laws, and the most powerful armies, could ever accomplish. A pamphlet has recently appeared in Paris, "On Postage, and the Taxation of Letters by means of a Stamp;" it is the production of M. Piron, sub-director of the French post-office. The project of M. Piron will bear no comparison with the enlightened views of Mr. Rowland Hill; but, compared with the present system, it is an immense stride in the career of civilization. An uniform rate of one penny is proposed, within certain limits; but to frank a letter to any part of the kingdom, a tenpenny stamp is required, which detracts very much from the merit of the system of M. Piron; but notwithstanding the defects of this project, it is clear from the quarter whence it emanates,

that something is intended to be done, and will be done while we are talking about it, if greater activity is not speedily displayed by our legislature. America, Prussia, and Belgium, have also in contemplation the adoption of plans similar to that of Mr. Rowland Hill; but let us hope that England will be the first to put the great scheme in practice, without mutilation, and without compromise.

METEOROLOGY.

EFFECTS OF THE LIGHTNING ON THE HOTEL DES INVALIDES.

The French Academy, at a recent meeting, appointed a committee to examine the effects of the lightning upon this edifice, and to ascertain if, as had been supposed, the continuity of the conductor had been interrupted before it was damaged by the lightning. It results from the inspection of M. Arago and M. Savary, and the information which they have obtained on the spot, corroborated by the statement consigned in the report of the architect of the building, that *after* the passage of the fluid, one of the metallic chains which served as a conductor, was found broken; but this chain, six days before the storm, that is to say the 2nd of June, had been examined by the officers of the establishment, and the point where the fracture has taken place is so situated, that it is impossible it could have been passed unobserved, if it had been in the bad state as had been supposed.

At a subsequent examination immediately after the storm, it was discovered that there was not a simple separation as might result from the oxidation of the metal, but a length of at least 30 centimetres had been broken into pieces of equal length, about 40 millimetres each. This chain is composed of about twenty iron wires, forming a kind of rope. At the place where it was broken, it passed through an iron ring in a wall, and in order to diminish the effect of its weight, it was twisted twice round the ring. This injudicious adjustment was probably the cause of the accident, since we have several examples of a conductor being entire, but forming in a point a sudden inflection, the electrical fluid has abandoned it at this point, and proceeded forwards in a straight line. It must, however, be observed in the present case, that this knot has existed since the first erection of the conductor, and it has never hitherto caused any accident. The effects of the electrical discharge, besides the rupture of the chain, are as follows:—

1st. About 60 of the nails which fix the gilt lead round the lantern of the dome, upon a circumference of about 20 metres, and at a height of at least 50 metres above the point of rupture of the chain, were violently forced out and scattered in every direction.

2nd. The lead is raised to the height of 30 or 40 millimetres, where the nails were forced out.

3rd. The lead which covered the base of one of the columns of the lantern has been torn off, and not the least vestige of it can be found; neither is there any trace of fusion or of vitrification.

4th. After the rupture of the conducting chain, the lightning darted upon a small building which contains the baths; it has broken into four pieces, a stone measuring $1\frac{1}{4}$ metre in height, by 0.30 in breadth, and weighing 77 killogrammes. This stone was not attached to the wall by any metallic fastening, but it covered the orifice of a leaden pipe, which served to discharge the water from the reservoir of the baths. It was remarked that the four pieces which were thrown to the distance of four metres from the wall, were not projected in the direction of the lightning, but in a direction nearly opposite to it.

5th. To the right of the stone abovementioned, is a door leading to the chamber of the baths. This door was open at the moment when the lightning struck the stone; the chamber contained twenty copper baths, cocks, pipes, and pumping apparatus, but the fluid did not penetrate, and the person who was at the door received no injury.

6th. Further to the right is a window protected by an iron grating. The three great squares of this window were broken into pieces, the largest of which was scarcely two centimetres square.

7th. On the roof of this building above the door, several slates were pierced with holes, as if they had been exposed to a discharge of small shot.

THE LAW OF STORMS.

(From the Literary Gazette.)

The labours of Col. Reid have so directed and rivetted general attention to the momentous questions involved in the law of storms, that every contribution of facts connected with the phenomena has become of public value. In this light the following may be received:—"On March 30, 1836, at four a.m., being in the brig *Matilda*, of St. John's, N.B., off the Bay of Naples, the island of Ischia bearing east, and distant ten leagues, it blowing hard N.W., and thick weather, I observed

a very curious appearance in the N.W. It seemed columnar, and like a light-house enveloped in a white blaze of fire, and continued so for fifteen or twenty minutes, and then disappeared. Immediately afterwards the wind fell to a moderate breeze, and the weather cleared up, when we had a fine pleasant day." This is authenticated by the signature of John Buckley, mate of the barque *Barlow*, and was recently sent to Col. Reid, the recipient of a number of similar communications respecting remarkable water-spouts. That gallant and intelligent officer, we are happy to state, has arrived in safety at his government in Bermuda; and we may add, that the men posted at the signal stations there, are ordered to observe the mode of action of water-spouts, which are of frequent occurrence in these latitudes, and to describe them in their own manner, which description will be published in the newspapers. The example ought to be followed whereever an opportunity is offered. There was an instance lately seen at Bermuda, which is described as having appeared of a reddish colour in the middle, although the sun was not shining at the time. A collection of data is likely to lead to very curious and interesting discoveries in this new and important branch of science.

STORMS IN FRANCE.

The French provincial papers are filled with accounts of the storms in various parts of the country, more violent, and more widely extended, than has been experienced for many years past. The lighthouse on Cape Ferret, near Bordeaux, was struck by lightning on the 16th June, and much damaged. A workman who had taken refuge in it was killed. At Cravant (Loiret) a female was killed while making hay; her clothes were much injured, and her shoes, the soles of which were rent to pieces; but the body presented no other trace of injury than a slight mark upon the head. Her mistress, who was standing by her side, escaped without injury. At Magne, near Niort, a farm was burned by the lightning, and one of the servants was killed by the fluid. His clothes were rent into fragments. At Vendome, great loss has been occasioned by hail storms. At Boulogne, the Liane rose in some places ten feet, from a storm attended with thunder and lightning, and the houses west of the port were flooded in their ground floor. Some of the inhabitants had to escape in boats.

CENTURY OF INVENTIONS.

BY THE MARQUIS OF WORCESTER, 1655.

(*Concluded from page* 236.)

91. "An artificial horse, with saddle, and caparisons fit for running at the ring, on which a man being mounted, with his lance in his hand, he can at pleasure make him start, and swiftly to run his career, using the decent posture with *bon* grace, may take the ring as handsomely, and running as swiftly as if he rode upon a barbe.

92. "A screw made like a water-screw, but the bottom of iron-plate, spade-wise, which at the side of a boat emptieth the mud of a pond, or raiseth the gravel.

93. "An engine whereby one man may take out of the water a ship of five hundred ton, so that it may be caulked, trimmed, and repaired, without need of the usual way of stocks, and as easily let it down again.

94. "A little engine, portable in one's pocket, which placed to any door, without any noise but one crack, openeth any door or gate.

95. "A double cross-bow, neat, handsome, and strong, to shoot two arrows, either together or one after the other, so immediately that a deer cannot run two steps, but if he miss of one arrow, he may be reached with the other, whether the deer run forward, sideward, or start backward.

96. "A way to make a sea-bank so firm and geometrically strong, that a stream can have no power over it; excellent, likewise, to save the pillar of a bridge, being far cheaper than stone walls.

97. "An engine, so contrived, that working the *primum mobile* forward or backward, upward or downward, circularly or cornerwise, to and fro, straight upright or downright, yet the pretended operation continueth, and advanceth, none of the motions above-mentioned hindering, much less stopping the others; but unanimously, and with harmony agreeing, they all augment and contribute strength unto the intended work and operation; and therefore I call this a semi-omnipotent engine, and do intend that a model thereof be buried with me.

99. "How to make one pound weight to raise a hundred as high as one pound descending, doth what nothing less than one hundred pound can effect.

100. "Upon so potent a help as these two last-mentioned inventions, a water-work is, by many years' experience and labour, so advantageously by me con-

trived, that a child's force bringeth up a hundred foot high an incredible quantity of water, even two feet diameter, so naturally, that the work will not be heard into the next room; and with so great ease and geometrical symmetry, that, though it work day and night, from one end of the year to the other, it will not require forty shillings' reparation to the whole engine, nor hinder one day's work. And I may boldly call it *the most stupendous work in the whole world*; not only with little charge to drain all sorts of mines, and furnish cities with water, though never so high seated, as well to keep them sweet, running through several streets, and so performing the work of scavengers, as well as furnishing the inhabitants with sufficient water for their private occasions; but likewise supplying rivers with sufficient to maintain and make them portable from town to town, and for the bettering of lands all the way it runs; with many more advantageous, and yet greater effects of profit, admiration, and consequence. So that deservedly I deem this invention to crown my labours, to reward my expenses, and make my thoughts acquiesce in way of further inventions:—This making up the whole century, and preventing any further trouble to the reader for the present, meaning to leave to posterity a book, wherein under each of these heads, the means to put in execution and visible trial all and every of these inventions, with the shape and form of all things belonging to them, shall be printed by brass plates.

In Bonum Publicum,
ET
Ad Majorem DEI Gloriam."

It would exceed the space which we can conveniently allot to the consideration of these inventions to comment largely upon each of them; one of the last recited has, however, been so admirably accomplished, that we cannot pass it unnoticed—we allude to No. 97. It was formerly considered an exaggerated account of the camera obscura, but the use of that instrument requires some skill, and the representation is at best confined to outlines: the Daguerrotype has, to the fullest extent, accompliahed all that the Marquis of Worcester did, or possibly could, anticipate. 91 and 98 are worthy of some consideration; but the two last, 99 and 100, prove that the author had not put in practice *all* the hundred "Scantlings of Inventions:" these two are manifestly fallacious and impossible. It is, however, as we have before observed, highly probable that many of them were really executed; and although we cannot deny the fact, that the noble author has affirmed that he has practised things that are impracticable, it must by no means be inferred that he did so with the intention of misleading; it is probable, on the contrary, that his intention was to encourage and stimulate genius to the pursuit of objects which he had himself vainly sought to attain.

ORIGIN OF PRINTING.

To the Editor of the Mechanic and Chemist.

Sir,—In a recent number of the "Mechanic and Chemist, you alluded to a passage in Cicero, from which, in common with many others, you infer that the Romans were at least acquainted with the use of moveable types. You may, therefore, think it worth while, when you have any spare room, to insert the following brief account of a Latin tract written by the celebrated John Toland, a hundred years ago, on the origin of printing.

This author takes notice of two passages in Cicero, in which type or stamps are mentioned; one in the book on "Divination," where we meet with the words "imprimendi literas (of stamping letters), and the other in the book on the "Nature of the Gods," to which you have already referred. In the latter, after speaking of the doctrine that the various parts of the world came to together by chance, Cicero adds, "I see no reason why the man who can believe this, should not also think, if an indefinite number of *forms*, or types, of the twenty-one letters (made of gold, or of what you please) were thrown together, that these, when scattered npon the ground, might make up by chance, the annals of Ennius, so that they could be read; though I doubt myself whether fortune would have the power to form a single verse in this way." Toland reasons upon these passages, and thinks it by no means improbable that they suggested our modern system of printing. He is disinclined to believe that the art came from China, whether through Venice or by any other road (on account of the essential difference between the types of that country and our own); and he seems to think, that it is refining too much to suppose that it came gradually from the very old customs of stamping cattle with hot irons, and making impressions from signet-rings. Towards the conclusion of his tract, he gives an anecdote from Procopius, which I am tempted to repeat, as it shows how superior most English workmen are to many a monarch of antiquity. The emperor, Justin I., was so illiterate, that they could

not teach him to write his own name; they therefore hollowed out the four letters, JUST, in polished wood, and when he had occasion to sign a paper, the pen was put into his hand, and guided by his attendants down these incisions!

I am, Sir, yours truly,
C—s C—r.

P.S. The name of the tract is "De Inventione Typographiæ." and, I believe, it is in every edition of his works.

NEW AND WONDERFUL DISCOVERY.

THE most important recent discovery is the one applicable to the reprinting of books, or re-production of engravings. M. Dupont, a very industrious printer, was seeking the means of saving the expense of stereotyping. With the assistance of a particular ink, he was already enabled to avoid the preservation of the *clichès*, which require many materials, and much place and money, by the means of the preservation of a mere printed sheet, which lithoraphy afterwards reproduced whenever it was wanted; but doubting whether the ink used upon that sheet would retain in course of time the same properties, he consulted his brother, a very intelligent lithographer, and the latter found what neither ventured to expect. This new process is applicable not only to fresh printed sheets, but likewise to the oldest engravings, to the oldest books, and, which is of far more interest, to Greek, Chinese, and Hebrew books. It consists in two operations. Over the page or engraving of which you want a copy, you lay a particular composition. It is placed upon the lithographic stone and pressed, and the stone reproduces, with scrupulous precision, the original engraving or book. This impression could not, however, serve such as it is. It is itself covered with the same preparation, and it may then print thousands of copies by the ordinary process of every sort of lithography. Five minutes suffice for both operations. The original engraving may be restored to the portfolio which has supplied it, for it has not been in the slightest degree injured; the book, thus wholly reprinted, may undergo another binding, and honourably resume its place in your library. This new process admits of a reduction of 75 per cent. upon the expense of printing; and as for engraving, that which on copper would have cost 100 francs, will now cost but 20 francs! What consequences will not this discovery yield! It threatens the graphic arts, engraving, and printing, with a complete revolution. A man of the greatest talent in the arts lays claim to priority in this discovery, as is always the case, when success has been obtained claims come in.* The wisdom of the central jury and patent laws must decide the question. In the mean time MM. Duponts are manufacturing, which is always a great point. On Monday, the King, Queen, Madame Adelaide, and Princess Clementine visited again the exposition, and examined the lytho-typographic produce of the brothers. His Majesty observing an engraved head of Albert Durer, of 1527, which was wanting in his collection of the Palais Royale, ordered a copy of it, and congratulated MM. Duponts upon a discovery whereby there would be no longer any scarce engravings or books.—*Paris Periodical.*

THE CHEMIST.

ELECTRICITY.

LATERAL DISCHARGE FROM LIGHTNING CONDUCTORS.

A SERIES of experiments were tried on Thursday at the Colosseum, on this subject, the object of which was, to ascertain how far any danger was to be apprehended from a lateral discharge, which invariably takes place during the passage of lightning down a conductor, this being a subject at present of paramount importance, and now before the Lords of the Admiralty. The existance of a lateral discharge is, strange to say, denied by a few of our scientific men; but as one experiment is at all times worth a hundred theories, the following may prove interesting:—A Leyden battery was charged by the large plate electrical machine in the usual way, and a brass cup, containing spirits of wine, was placed in connexion with the outside of the battery. A piece of copper wire, totally unconnected with the battery, was placed on the floor, one end of which was bent over, but not brought in contact with the spirits. On discharging the battery in the usual way, by bringing a conducting wire in contact with the inside and outside coatings, the spirit was fired by the lateral discharge. The experiment was conducted by W. E.

* Some years ago a printer at Geneva, by means of a similar process, copied the Paris daily papers, and distributed them, at an inferior price, two hours after the arrival of the mail. They were not so distinct as the original, but just legible. Complaints were at length addressed to the Geneva government, and this kind of publication was disallowed.—ED. M. and C.

M. Clark, under the directions of Martyn Roberts, Esq., in presence of F. W. Faxon, Esq., proprietor of the colossal electrical machine, and Mr. W. Leithead. The electrical machine is seven feet in diameter, being the largest in the world.—*Morning Paper.*

NEW STEAM-ENGINE.

The following account of a new rotary engine, invented by Mr. Rowley, is given in the *Manchester Chronicle*:—"It is well known that repeated attempts have been made, for a number of years, to apply the power of steam in such a manner as to produce a direct rotary movement, without the intervention of cranks, or other complicated machinery; but, although many rotary engines have been constructed, none on trial has possessed such advantages over the engines in common use, as to lead to even a partial adoption; having been found deficient in power, and saving of fuel, though capable of great rapidity of motion. These difficulties have, we think, been most successfully overcome by Mr. Rowley, surgeon, R. N., who has invented a rotary engine, combining the advantages of simplicity of construction, with rapidity of motion, greater power than a common engine of the same size, and a saving of fuel of upwards of 20 per cent. One of six-horse power, constructed upon these principles, by Messrs. Glasgow and Mayburn, of Traflord-street, and which has, for the last three months, been regularly working at the bed-ticking manufactory of Messrs. Johnson and Co., Garrat-road, has fully justified the most sanguine anticipations of the inventor. This engine consists of a circular steam-tight case, in which revolves a wheel of such a diameter as to leave a sufficient space round its circumference for the action steam; this space being divided into two equal parts by a solid abutment, on the sides of which the induction and eduction pipes are placed. This wheel is fitted with two or three pistons, which work within the wheel, so as to pass the abutment, afterwards projecting into the steam chamber, and forming a resisting surface against which the steam acts, and consequently propels the wheel, the axis of which passes through the case, and is connected with the shafting of the machinery to be put in motion. Mr. Rowley has in progress of construction, by the same engineers, upon the same principles, a railway locomotive engine, which will, we believe, be the first rotary engine applied to locomotive purposes, and which promises as successful a result as his first experiment. When we add to our account that the inventor intends applying the same principle to marine engines, we cannot hesitate in advancing the opinion, that Mr. Rowley's invention is calculated to form a new era in the history of the steam-engine."

SOLUTION OF PROBLEM.

To the Editor of the Mechanic and Chemist.

Sir,—I must intreat your pardon for presuming to address you, but finding in your valuable magazine for 8th of June, a question in algebra, and as I understand an answer was required from any of your subscribers, I thought I might venture, as having been one to a publication I always much esteemed since its commencement.

I remain yours, &c.

John Yates,
Corporal 8th Battalion, R.A.
Woolwich.

Therefore cubing $\sqrt[3]{a+\sqrt{x}}+\sqrt[3]{a-\sqrt{x}}=\sqrt[3]{b}$.

We have $a+\sqrt{x}+3\sqrt[3]{(a+\sqrt{x})^2}\sqrt[3]{(a-\sqrt{x})}+3\sqrt[3]{(a+\sqrt{x})}\,(\sqrt[3]{x(a-\sqrt{x})^2}+$

Or, $3\sqrt[3]{(a+\sqrt{x})}\,(\sqrt[3]{(a-\sqrt{x})}\,\left\{\sqrt[3]{(a+\sqrt{x})}+\sqrt[3]{(a-\sqrt{x})}\right\}=b-2a.$

Or, $\sqrt[3]{a^2-x}=\dfrac{b-2a.}{3\sqrt[3]{b}}$ (For by the question $b^{\frac{1}{3}}=\sqrt[3]{a+\sqrt{x}}+\sqrt[3]{a-\sqrt{x}}$).

Cubing, we have $a^2-x=\left(\dfrac{b-2a}{3\sqrt[3]{b}}\right)^3$

Or, $x=a2-\left(\dfrac{b-2a}{3\sqrt{b}}\right)^3$

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-Buildings, Chancery-lane. Wednesday, July 10, B, Seare, Esq., on the Writings of Charles Dickens. Friday, July 12, W. H. Stoker, Esq., on Music. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, July 11, Harman Lewis, B. A., on Voltaic Electricity. At half-past Eight o'clock.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, July 9, Dr. B. D. Thomson, on the Water supplied to the Metropolis. At a quarter to nine.

QUERIES.

What is the best mode of rendering leather fishing-boots water-proof? W. J.

How to harden, without warping, steel rods, about six inches long and half an inch thick, which are turned perfectly true? Also an account of "Count Suardi's geometric pen?"
Birmingham. R. S. D.

By what means can I erase grease spots from paper, which has accidentally dropped on? R. E. W.

ANSWERS TO QUERIES.

To make German Paste.—Take of Valentia almonds dried, 2 ounces; powder them coarsely with 4 rusks, and 1 pound of pea meal; ½ ounce of moss seed; 1 pint of fig-dust; 30 grains of mixed spice; when these are mixed, add four ounces of honey (English); 5 ounces best treacle; 3 ounces fresh butter, and three yolks of eggs, boiled very hard; let these be passed through a sieve, and baked afterwards in an oven.
W. W. R.

To make Golden Ink.—Sir, I beg to inform "E. J. S." No. 25, N.S., that golden ink may be made in the following manner:—Take some white gum Arabic, reduce it to an impalpable powder, dissolve it in strong brandy, and add a little water to render it more liquid; provide some powdered gold in a shell, moisten it with the gummy solution, and stir the whole with a small hair brush; then leave it for a night, that the gold may be better dissolved. If the mixture become dry during the night, dilute it with more gum water, till it is liquid enough to flow freely from a pen; when it is dry, polish it with a dry tooth. Heje.

TO CORRESPONDENTS.

A Reader.—*Zinc may be soldered with in solder of the finest sort; but instead of resin, spirits of salt (muriatic acid) must be applied to the parts required to be joined. Dip a piece of wood in the acid, and draw it over the part, and apply the soldering iron immediately after. The same process is employed for soldering zinc to copper, but the copper must be previously tinned.*

C. Graystone.—*Various receipts for making Seidlitz powders, and also for making French polish, have been given in "The Mechanic."*

A Constant Reader.—*A colour exactly resembling gilding may be imparted to brass by a very simple and easy process:—Make the surface to be coloured quite clear, and attach the article to a wire (not iron or steel), and plunge it into strong aqua fortis (nitric acid); after it has remained about two seconds, take it out and wash it in clean water as quickly as possible. This colour will not be permanent, unless protected by a transparent varnish.*

Erasmus, junior's, *request shall be complied with.*

J. S. R.—*The steam guage differs from an ordinary barometer, in containing air in the tube above the mercury; when the mercury rises in the tube, the air above is compressed, and consequently presses with great force on the surface of the mercury. Common air is subject to lose a portion of its oxygen by exposure to the surface of the mercury. Hydrogen or azote would be preferable, especially the latter, on account of its extreme inertness. If a gauge were constructed on the principle of a barometer, a tube between twenty and thirty feet long would be required to measure the pressure of ten atmospheres. In consulting the steam-guage, attention must be paid to the temperature of the air in the tube; the higher the temperature, the lower will be the indication of the pressure, and vice versa. The scale being composed of unequal divisions, the surest plan is to mark them from actual trial at the ordinary temperature, and afterwards correct for any excess of heat, by adding to the indicated pressure, and for a deficiency, subtracting from it. These quantities may also be found by experiment.*

NEW WORK

(To be completed in Twenty Monthly Numbers), price 6d.

This Day is Published, the Second Edition of No. I. of

WILL'S WHIM; consisting of Characteristic Curiosities, with Original Anecdotes of Men and Things. Illustrated by Jacob Parallel, Esq.

PLAN OF THE WORK.

Every Number will exhibit the Virtues, Vices, or Follies, of Human Life, as they every day appear, in their most amiable, most subtle, or most eccentric forms. Of such characters, however, those only will be selected as, it is presumed, will afford a pleasing interest in the perusal of their actions, from their respective peculiarities in attaining their favourite objects.

In addition to our other details, we shall occasionally diverge into the very depths of drollery of every denomination. The not unfrequent comic tragedies of real life, the burlesque of intuitive discovery, the epicurean sentimentalities of modern refinement, are all fair game for the goose quill; and in pursuit of which, while we hope to prove ourselves good marksmen, we will only premise here, that it shall be our special aim never to overshoot the mark.

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. XXXIII. & XXXIV. NEW SERIES. — SATURDAY, JULY 13, 1839. (PRICE TWO PENCE.) — Nos. CLIV. & CLV. OLD SERIES.

FORMATION OF THE RAINBOW.

FIG. 1.

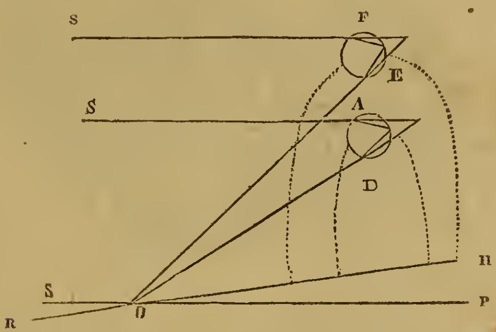
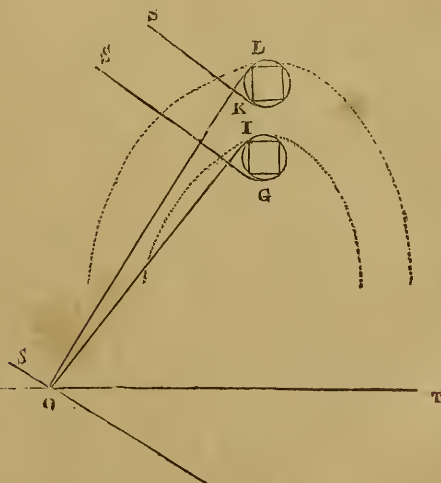


FIG. 2.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

ON THE RAINBOW.

THE explanation of this beautiful phenomenon belongs to catadioptrics: that is, the combined effects of refraction and reflection. Antonius Dominis first discovered that the interior, or primary bow, is caused by two refractions of the sun's rays at each drop of water, and one reflection between them, as represented at E F, and D A, fig. 1 This discovery he confirmed by experiments, which have been successfully repeated by more modern writers. If glass globes, filled with water, be placed in the sun's light, they may be elevated or depressed till they successively transmit to the eye the colours of each bow, in their proper order. When a ray of light is incident on any transparent surface, the whole ray, or, more properly, pencil of rays, does not enter into the transparent substance, a portion of it being reflected back, as may be seen when the sun is shining against a glass window, &c. It is also found, that in passing through a transparent body, the whole pencil does not emerge, a portion being reflected by the surface, from which the greater number of rays emerge. This effect is apparent in the diamond; a ray of light passes through the stone, and is reflected by the back surface; and if it be incident obliquely on the first surface, it suffers two refractions and one reflection, as in the rainbow, and the prismatic colours are accordingly exhibited in their proper succession.

We are very much deceived by the appearance of the rainbow; we take it to be an object of great magnitude, and at a great distance, when it is, in reality, within a very few yards of the spectator, though it may extend in the proper direction, as far as the sun's rays meet with drops of rain. Coloured rays are emitted from every drop of water which receives the light of the sun; but those only are directed towards the eye of the spectator which are situated at the surface of a cone, generated by the revolution of O E, O D, or any intermediate line, according to the colour, about the axis O P. Let O be the eye of the spectator; S O P, a line passing through the eye and the sun. At the point O, in the line P O, make the angle P O E = 40° 2′; then, when a drop of rain, F E, is in such a situation that the angle which O E makes with a perpendicular to its surface at E, is 59° 23′, a small pencil of parallel red rays will emerge from it at E, and enter the eye in the direction E O: for if O E be considered as the incident pencil, it will emerge after two refractions and one reflection, in the direction F S, which makes an angle of 137° 58′ with O E produced, or an angle of 42° 2′ with O E, and is therefore parallel to O S; thus S F will pass through the sun. Conversely, out of the beam of the sun's light which falls upon the drop, the red rays incident at, and near to F, will, after two refractions and one reflection, emerge parallel, and entering the eye in the direction E O, will excite the sensation of their proper colour. In the same manner, if O E revolve about the axis O P, every drop of water in the surface of the cone thus described will transmit to the eye a small parallel pencil of red rays; and thus a red arc, whose radius, measured by the angle which it subtends at the eye, is 42° 2′, will appear in the falling rain opposite to the sun. The other red rays of the beam which fall upon the drop F E, will, at their emergence, be inclined at different angles, to the direction of the incident rays, and be so much dispersed before they reach the eye, and enter it in so weak a state, mixed other rays, as to produce no distinct effect. The parallel pencils of red rays, which emerge from other drops, fall above or below the eye.

If the angle P O D, be 40° 16′, and O D revolve about the axis O P, every drop of rain in the surface of the cone thus described, will transmit to the eye a parallel pencil of violet rays; and thus a violet ray will be formed, whose radius is 40° 16′.

The drops between E and D will transmit to the eye parallel pencils of rays of the different colours, orange, yellow, green, blue, indigo, in the order which they have in the prismatic spectrum.

Beyond the primitive, there is a secondary and fainter bow observed, in which the order of the colours is reversed; the red forming the exterior ring of the primary, and the interior ring of the secondary bow.

Let the angle P O I (fig. 2.) = 50° 58′; and the angle P O L = 54° 10′. Also, let O I, O L, revolve about the axis O P. Then it may be shown, as in the preceding case, that every drop of rain in the conical surface, generated by O I, will transmit to the eye a small parallel pencil of red rays, which has suffered two refractions and two reflections, but sufficiently strong to excite the sensation of its proper colour. Also, every drop in the conical surface, generated by O L, will transmit to the eye a small pencil of parallel violet rays; and the intermediate drops, parallel pencils of the intermediate colours. Thus the exterior bow is formed, in which the

radii of the red and violet arcs are, respectively, $50^{0} 58'$, and $54^{0} 10'$.

Were the pencils sufficiently strong, a third bow, formed by two refractions and three reflections, might be seen. But when the rays which are refracted into a drop of water reach the farther surface, some of them pass out of the drop, and others are reflected within it. When these reflected rays again meet the surface, some of them pass out of the drop, and others suffer another reflection; and so on. Thus the pencil becomes weaker at every reflection; and at length in contains so few rays as not to make a distinct impression upon the retina.

Those who desire to enter more deeply into the subject may consult "Wood's Octics," (Cambridge), from which source a portion of the foregoing is derived.

THE EFFECT OF STRIKES.

When a body of men combine together for the purpose of organizing a strike, the inevitable consequences are, immediate inconvenience, embarrassment, and distress; permanent injury to their cause, by destroying the mutual confidence and good-will which it is desirable should exist between themselves and their employers, and serious loss to commerce, not only in a particular district, but affecting the whole nation, as competing with foreign rivals. The extent of this last evil, is clearly set forth in the statement of Mr. E. Tuffnell, extracted from a report of the constabulary force committee of the House of Commons just published. We recommend its perusal and serious consideration to the working men of this country:—

"An evil of far more serious import to the nation, is when the manufacture, instead of changing from one part of the country to another, leaves it altogether, and takes refuge in foreign parts. This has actually taken place in some instances, and the rapid increase of continental rivalry, by teaching foreigners to adopt our habits of industry, and our improved machinery, daily renders it easier for them to supplant us in the market. It is obvious, indeed, that if this effect has not more generally followed, every additional attack on the profits of the home manufacturer must have this tendency, and augment the chances of foreign products successfully competing with British. In 1820, a Glasgow cotton manufacturer emigrated from that city, and established a factory at New York, that he might conduct his business free from those interruptions to which he was subjected in this country from the strikes among his men. The conduct of the Sheffield workmen already threatens the extinction of the trade of that town, and it is passing over to our French and German rivals. At present the same labour in the manufacture of saws which cost 15s. or 20s. at Sheffield, can be done for 1s. 3d. at Molsheim, in the neighbourhood of Strasburg. The consequence is, the exportation of this article to the Continent, which was considerable some years ago, has almost wholly ceased; many other of the Sheffield productions have shared the same fate; and America is almost the only market that is left for the sale of the manufactures of that town. The condition of a large proportion of the Sheffield operatives is far worse with respect to comfort than at any preceding period, and

the town exhibits the extraordinary spectacle—the inevitable result of successful combinations—of high wages, a decaying trade, and a destitute population. The business that remains is now dependent on our friendly relations with the United States; war, or the policy of a tariff, may equally extinguish it; and should that happen, the Sheffield workmen may perhaps at length learn, amidst unavailing regrets, that the question has not been whether they shall get high or moderate wages, but moderate wages or none at all. An instance of transference of a manufacture to the Continent, in consequence of strikes, has lately occurred in the woollen trade. The workmen in a large cloth-dyeing establishment in Yorkshire turned out for an advance of wages. It happened that the firm were large exporters of *finished* cloth to Germany, where they possessed a small dyeing factory, of which, however, little use was made. The proprietors, on the stoppage of their business in England, were induced to try the experiment of sending the greater part of their cloth, in a white state, to Germany, and dyeing it there, where they could be free from the dictation of trades' unions. It is but fair to add, that other causes may have contributed in inducing the firm to try this new speculation; among others, the high duty on drugs in England, and the low duties on the importation of undyed cloth, as compared with dyed cloth, into Germany. The experiment not only answered expectation, but many other unlooked-for advantages resulted from the change. A saving was made in the expense of insurance, as the article was less valuable when in course of transit; there was also less risk of its being spoilt by sea-water, as the subsequent dyeing remedied any damage it might sustain from this cause. Consequently, the proprietors in question have been transferring their dyeing business to Germany, carrying their skill and experience with them: large additions have been made to their foreign factory; and whereas, before the strike, they did not export more than 500 pieces of undyed cloth yearly, they now send from 1000 to 1200 in the same time. As increased profit has attended this change in the locality of their dyeing trade, it is clear that this firm will never bring back its business to England; on the contrary, it is to be feared that the example will be imitated by other firms, and the eventual result may be, that the profit of dyeing all the cloth that is sent to Germany, amounting to nearly 20,000 pieces annually, may be lost to this country.

The strike of the frame-work knitters in 1817 and 1818, had an effect on our export trade of hosiery articles which is felt to this day. In those years the foreign buyers of these goods, being unable to obtain their usual supplies from the English manufacturers, in consequence of the turn-out, went to Germany to make their purchases. From that period the Germans got a hold on the export trade of hosiery, which they have been yearly increasing, assisted as they have been by numerous strikes of the workmen in this country. Great part of the hosiery articles which our ships export from England, is in fact not made here, but at Chemnitz, in Saxony; and it only comes to London to be exported to America, and other quarters of the world, a duty of 20 per cent. preventing its consumption in this country. Now, we will suppose the Derby and Leicester workmen to succeed in a strike, and to raise their wages to such a degree, that the price of the articles they make is increased 20 per cent. The foreign hosiery, which is now in the king's warehouses under lock and key, would instantly have the duty of 20 per cent. paid on it, be brought into our market, and the triumphant workmen and their masters be ruined directly. As it is, the strikes have done irreparable damage to this trade, and the flourishing German town of Chemnitz owes great part of its prosperity to the trades' unions of this country. It cannot be other than a pleasing sight to see the large population of a place like Chemnitz happy, contented, and employed. But what must be the feelings of an Englishman, when looking on that smiling scene of peaceful industry? The pleasure with which he regards it cannot but be mingled with some feelings of sorrow, if the thought should strike him that that prosperity might have been English—that that employment, that happiness and contentment, is so much torn from England by the folly of the Derby and Leicester workmen. A century and a half ago the King of France drove great part of the silk trade from that country to this by his tyrannical edicts: our workmen are in a fair way to do the same with respect to England by their trades' unions."

RESTORATION OF ARMAGH CATHEDRAL.

To the Editor of the Mechanic and Chemist.

Sir,—I wish to call your attention to an ingenious experiment, lately tried with complete success. The Archbishop of Armagh, anxious to restore his ancient ca-

thedral to its former beauty, engaged for that purpose Mr. Cottingham, an eminent architect. Mr. Cottingham, after a careful examination of the various parts of the building, gave in a most favourable report, though he at once perceived that the pillars of the arches between the side aisles and the nave declined considerably from the perpendicular. To remedy this defect (on the south side of seventeen inches, and on the north side of seven inches), he thought of the experiment of M. Molard, successfully tried at the Conservatoire des Arts et Metiers, in Paris. By the contraction of iron rods, he hoped to restore the columns to their perpendicular. Having passed six of these rods across from column to column, he secured them with nuts on the outside. He then suspended from each rod a trough of charcoal, by the heat of which several rods expanded, so that he was enabled, before they cooled and contracted, to screw each nut about half an inch. By working in this manner, he gradually raised the declining walls, so that they are now as erect as walls need be. I may remark that the columns during the operation, were firmly cased in wood, and that the cracks at the base of each were immediately filled up with solid masonry.

I remain, Sir, ever yours,

T. C. D.

[The mode of operating is this :—a number of strong iron bars are passed from one side to the other, of that part of the building which it is desired to draw together, and they are screwed as tight as possible by means of nuts on the outside; heat is then applied to half the number of bars, leaving a cold one between each two hot ones, so that the building cannot follow the expansion of the iron, being held securely by the cold bars. The nuts of the expanded bars which now project beyond the wall, are again screwed up tight, and the fires removed, and the operation is repeated till the desired effect is produced. —ED.]

URANIAN SOCIETY.

A PRELIMINARY meeting was held on Tuesday evening, in the Meteorological Society's rooms, Bartlett's-buildings, Holborn, for the purpose of forming a society under the above name, having for its object the advancement of astronomical science.

W. H. White, M.B.S., senior secretary to the Astronomical Society, having been called to the chair, the following resolutions were passed: –

1st. That this Society be called the "Uranian Society," and consist of *members*, if resident within twelve miles of the place of meeting, and *associates*, if resident at a greater distance.

2nd. That the objects of this society be the advancement of astronomical science by means of discussion, aided by a regular and continued series of observations, and extended correspondence.

3rd. That this society be governed by a president, vice-presidents, treasurer, secretaries, and a council, consisting of ten members.

4th. That the president and other officers be elected annually from among the members at large, and that the candidates proposed be submitted to the approval of the council.

5th. That candidates proposed for presidency and vice presidencies, be persons possessing a thorough knowledge of the science of astronomy.

6th. That persons for members, &c., be proposed by three members, one of whom shall certify from personal knowledge, and that their admission be decided by ballot.

7th. That the annual subscription of a member be one guinea, and that of an associate half a guinea, to be paid on admission.

8th. That the anniversary of this society by held on the 22nd of March, that day being the birth-day of the immortal Laplace.

The meeting then adjourned till Tuesday the 9th instant, at eight p m., when lovers of astronomy are cordially invited to attend.

OMNIVOROUS NATURE OF MAN.

As the physical capabilities of his frame enable man to occupy every variety of climate, soil, and situation, it follows of necessity, that he must be omnivorous, that is, capable of deriving sufficient nourishment and support from all kinds of food. The power of living in various situations would be rendered nugatory by restriction to one kind of diet.

If it was the design of nature, that the dreary wastes of Lapland, the naked and barren shores of the icy sea, the ice-bound coasts of Greenland and Labrador, and the frightful deserts of Terra del Fuego, should be not left entirely uninhabited, it is impossible to suppose that either a vegetable or even a mixed diet is necessary to human subsistence. How could roots, fruits, or other vegetable productions be procured, where the bosom of the earth is closed the greater part of the year, and its surface either covered with many feet of snow, or rendered impenetrable by frost of

equal depth? Experience shows us that the constant use of animal food alone is as natural and as wholesome to the Esquimaux, the Samoiedes, the inhabitants of Terra del Fuego, &c. &c., as the most careful admixture of vegetable and animal matters is to us. We even find that the Russians, who winter on Nova Zembla, are obliged to imitate the Samoiedes, by drinking fresh rein-deer blood, and eating raw flesh, in order to preserve their health. Dr. Aikin informs us that these practices were found most conducive to health in those high north latitudes. Hence, we shall be less surprised at finding men, in certain situations, living and enjoying health on what seem to us the most filthy and disgusting objects. The Greenlander and the inhabitant of the Archipelago between north-eastern Asia and north-western America, eat the whale, often without waiting for cookery. The former bury a seal, when they catch one, under the grass in summer, and the snow in winter, and eat the half-frozen, half-putrid flesh, with as keen a relish as the European finds in his greatest dainties. They drink the blood of the seal while warm, and eat dried herrings moistened with whale oil.

In the torrid zone, on the contrary, circumstances are very unfavourable to raising and supporting those flocks and herds of domesticated animals, which would be necessary to supply the numerous population with animal food. The number, fierceness, and strength of beasts of prey, the periodical alternations of rains and inundations, with the long-continued operations of a vertical sun, whose direct rays dry up all succulent vegetables and all fluids, are the principal and insurmountable obstacles. The deficient supply of flesh is most abundantly compensated by numerous and valuable presents; by the cocoa-nut, the plaintain, the banana, the sago-tree; by the potatoe, yam, cassava, and other roots; by maize, rice, and millet; and by an infinite diversity of cooling and refreshing fruits. By these precious gifts, nature has pointed out to the natives of hot climates the most suitable kind of nourishment: here, accordingly, a vegetable diet is found most grateful and salubrious, and animal food much less wholesome.

In the temperate regions of the globe, all kinds of animal food can be easily procured, and nearly all descriptions of grain, roots, fruit, and other vegetable matters; and, when taken in moderation, all afford wholesome nourishment. Here, therefore, man appears in his omniverons character. As we pass from these middle climes towards the poles, animal matters are more and more exclusively taken: towards the equator, cooling fruits and other produce of the earth constitute a greater and greater share of human diet.

J. W.

PREPARATION OF STEEL.

The manner of making steel is this: a bar of iron is heated in a vessel containing charcoal, and it is kept exposed for a long time to the heat. It is ultimately found that the bar of iron has been penetrated, or permeated, as it were, with the vapour of carbon, which has combined with it throughout, and formed carburet of iron. When withdrawn from the furnace it is found to be blistered; its fracture and general appearance are altered, and it is then known under the name of blistered steel. The bars of this first manufacture are heated again, and drawn down into smaller bars, by powerful machinery, and beaten, and it is then called tilted steel; which, when broken up and welded, and drawn into bars, forms shear steel; and this, when melted along with some vitrifying flux, and cast into bars, forms what is called cast steel, or English steel.

The properties of steel are exceedingly singular; its texture varies in different specimens; sometimes it presents more or less of a crystalline fracture, and silky in others; and the appearance of the fracture leads the artist to apply it to particular purposes. We should see, in the selection of steel for any particular use, that the fracture is regular; and if we see a spot in it more white than another, rub it over with nitric acid, and if the spot becomes darker, the specimen is not good steel. It melts more readily than iron, and it admits of welding or uniting with iron at high temperature. It has a great variety of curious properties, on which its value in the arts in a great measure depends. If we heat steel, and allow it to become cold again slowly, we anneal it, as it is called, and it is still more flexible than before; but by rapidly cooling it, it becomes so brittle that we may break it like glass. Steel, in this excessively hard state, is a very intractable substance; but if it be gradually heated up to a certain point, it again acquires a degree of softness; and if we heat it red hot, it becomes as soft as before. At a temperature of about 430 degrees it begins to soften; and at 600 or 700, it becomes very soft, and therefore, by proper management, the artist can give it any degree of hardness he may re-

quire; and this process is called the tempering of steel. The manufacturer of a razor, for example, forges out the blade in the soft state of the metal; he would then finish it, and render it hard by quenching it in water; after which it is heated, until he sees, by the colour of the blade, that it is brought down to the degree of hardness required.

A razor and a dinner knife may be made of exactly the same kind of steel; but the difference in their hardness depends upon their tempering. Polished steel, at 430, begins to acquire a pale straw-coloured tint; and from that to 465, it becomes so far tempered as to be fit for razor blades, and instruments of that kind, requiring delicate edges. From 480 to 500 degrees, it acquires a buff tinge, and becomes softer; it is now soft enough for penknives, and certain surgical instruments, and other purposes; at 500 degrees, or from 515 to 530 degrees, it becomes yellow, and begins to acquire a purple tint; from 530 to 550 degrees, it becomes decidedly purple, and is then fit for common knives, and other instruments requiring great toughness. At 550, or from that to 580 degrees, the steel begins to acquire a blue colour, and it is soft enough in that state for a number of purposes, especially for thin blades intended to have great elasticity and little hardness; and, at 590 degrees, it becomes so soft as to be bent without any risk of breaking, as is the case in watch-springs.—*Brande's Lectures.*

"NO MORE TO NIGHT, SIR!"

A RAILWAY TRIP.

(From a Correspondent.)

Having a leisure hour or two, and the weather, after a succession of wet and boisterous days, being very inviting, I said to my friend, when we had been conversing upon the almost-universal topic of railways, "What say you to a trip on the Great Western? The atmosphere is mild and clear, and I have no doubt we shall have a pleasant jaunt."

"With all my heart," he replied, "but shall we return in time to meet the engagement we have made for eight this evening?"

"O dear, yes!" said I; "the train which leaves Drayton at seven, will give us a good half hour to spare."

This point being settled, away we steered for the Spread Eagle, Gracechurch-street, as fast as my friend (who, by the bye, was not one of the smallest men in London), could manage.

"Are we in time for the Great Western five o'clock train?" said I, as we entered the office.

"The buss is just gone, Sir!" was the reply.—"But a cab will save it, your honour," added a little upstart fellow just by the entrance to the office, who, scarcely waiting a reply, had "signalled" one to the door. Into it we got, and, after ransacking our pockets for all the halfpence we could muster, in answer to "Please remember the porter—'arnt nothing today, master!" away we drove down Cornhill, and into Cheapside, where we soon had to encounter such a "mixture" (as the cabmen term it), as would have puzzled any chemist in the world to have analysed, much more to have separated. However, after a tremendous deal of buffetting and shouting for a good quarter of an hour, we found ourselves opposite the Post Office, and once more on a fair way to the station. But this we were not yet destined to arrive at, for in turning the corner by Smithfield Bars, down went the poor raw-boned creature, behind which we had been so unfortunate as to seat ourselves. The cab being one of the high, old-fashioned description, my poor friend stood but little chance of retaining his seat: out he went, and I quickly followed, though, by the bye, if his corpulence did not relieve the weight of *his* fall, it served as a very good cushion for *me* to alight upon. Once more on our feet, with no further injury than taking the polish off a new four-guinea black coat, and laming one of the hind legs of the poor creature that drew us, resuming our seats, off we set again, and arrived at the station just in time to be saluted with—"You're too late, gentlemen; the train is just gone."

Determined not to be defeated, now we had gone so far, we resolved to wait, and be at any rate "in time" for the next train. This, however, we were well nigh disappointed in, for, feeling a little inward faintness, I proposed, and my worthy friend cordially seconded, an adjournment to a neighbouring tavern, where, having called for a buiscuit and cheese, and a couple of glasses of their "best ale," we sat very leisurely carousing, until the landlord (a regular John Bull sort of fellow), stepping in, said, "I beg your pardon, gentlemen, but thinking you might be going to travel by the rail, I thought as how I had better inform you, that that there clock is a quarter of an hour too slow."

"Thank ye, thank ye!" we vociferated in a breath, as we hastily threw down a half-crown, and, without waiting for change, "made for the station."

We were the last in the carriages, the

orders, "Stand clear—move on," being given, the moment we had taken our seats, and in another second or two the snorting of our "leader" was heard, and away we went, under hill and over dale,—though all upon a level,—at more than giant speed.

From the sequel, however, it will appear we were destined to vexation; for what with stoppages at the "short stations," and an occasional "slackening of pace," to let our Steamer cool himself a little, we did not arrive at our destination until the train we had intended to have returned by, had left.

"What time will the next train start?" said I, as soon as we had witnessed the procedure of that we had just left.

"No more to-night, sir! The last train has just gone!"

Here was a start! It was now a quarter past seven, and our engagement was for eight!

"What's the nearest town, and how far is it to it?" asked my friend, the fat man, at the same time casting a hasty and rather mournful glance at his legs, as if in doubt whether they would support him the distance.

"You're two miles and a half from Uxbridge," was the reply.

"And have you no conveyance thither?" added I.

"The omnibus is just gone, sir!" said the policeman.

"Worse and worse!" thought I, as I took my friend by the arm, and, motioning him forwnrd, said, "We must travel thither on foot."

With no small degree of reluctance he acceded to my proposal; and, after a great effort on his part, and much vexation on mine, at half-past eight we found ourselves in Uxbridge.

Seeing an ostler at the gateway of one of the inns there, I stepped up to him, and inquired, "How long before the next stage passes through to London?"

"No more to-night, sir!"

The repetition of the same words seemed to my mind almost to denote a conspiracy against us, as, turning to my friend with a mixture of irony and vexation, I inquired, "Will you walk it?"

But that I knew was out of the question. My next interrogation, therefore, was, "Is there anything to be hired?"

"Yes!" said the ostler, "we have post-chaises, or single-horse flys."

The price being agreed upon, after partaking of some refreshment, we found ourselves once more "homeward bound." But our mortification was not yet at an end. Soon after we started, the horse—such an one as fifty shillings would purchase any Friday in Smithfield—began to "give out," and such a disrelish did his poor bones exhibit for his driver's whip, that at every stripe (which, you may be sure, was not very unfrequent), he took such a "lee-lurch" (as the sailors say) to avoid it, as threatened to tumble chaise, passengers, coachman, and all, into a deep muddy ditch, which every now and then we passed by the way-side; had this happened, I should surely have got the worst of it, as my friend sat to 'windward" of me; and, in the event of a downfall, I being a poor diminutive fellow, should undoubtedly have been crushed!

"Arrived, at length, at Brentford, and having paid the flyman his fare, our next inquiry was for an omnibus.

"No more to-night, sir! The last is just gone!" was again to us the familiar reply.

"And is there no chance of a stage?"

"No more to-night, sir!"

"Flyman, ahoy!"

"What now, your honour?"

"You must take us on to town."

"'Tis more than I dare do; and, besides, my old mare wouldn't go another mile further, not if you'ld give her a bushel of corn for doing on't."

There was no alternative—walk we found we must. Not contemplating such demands, our purses had well nigh emptied themselves; so that supper and a bed for the night, or another hired vehicle, was out of the question. We set out to walk, but I doubt whether we should have reached home before day-light, had not a post-chaise, returning from a wedding trip, come up with us; the postillions belonging to which were so drunk, that they could scarcely retain their seats. Into it we got, and, if I were alarmed before, I was ten times more so now, for such was the speed at which they were driving, that our "ship" rolled from side to side, as if the next moment she would be thrown upon her "beam-ends."

We were soon, however, in the city, and by the Bank, inquiring for an omnibus to take us to Highgate.

"No more to-night, sir! The last has been gone these ten minutes," said a waterman, who at the same time recommended us to take a cab—the only one upon the stand. We took his advice, and having at last reached home in safety, and explained to our astonished friends the reason of the non-fulfilment of our engagement, we resolved to be more guarded for the future in taking an "afternoon's trip by the railway."

Highgate. E. G. S.

REVIEW.

Will's Whim, illustrated by Jacob Parallel, Esq. London: G. Berger, Holywell-street, Strand.

A FACETIOUS publication, decorated with steel engravings in the "Boz" style, and well-executed wood-cuts, to assist the imagination of those who cannot perceive the wit of the text. Our reasons for not entering into the analysis of this production, are many and cogent; first, because it treats on no subject within the scope of "The Mechanic and Chemist;" second, because the author informs us at the outset, that "brevity is the soul of wit," and we cannot withstand the temptation of purchasing a reputation at so easy a rate; and, third, because *de gustibus non est disputandum*, and the reader may satisfy himself by purchasing No. 1, which has just appeared. Justice, however, requires that we should add, that the Number before us is entirely free from all objectionable expressions and inuendoes, which is not always the case in humourous performances; and we trust that the succeeding numbers will not be less deserving of praise than the present.

ON ECHOS.

To the Editor of the Mechanic and Chemist.

SIR,—I beg leave to send you the following explanation of the phenomena of echos.

I remain yours,

T. C. D.

The principles by which they may be explained are few and simple, viz., 1. That every point against which the pulses strike, becomes a centre of a new series of pulses; and, 2. That sound describes equal spaces in equal times. Therefore, when any sound is propagated from a centre, and its pulses strike against a variety of obstacles, if the sum of the right lines drawn from that point to each of the obstacles, and from each of the obstacles to a second point, be equal, then will the latter be a point in which an echo will be heard; for it is obvious that the pulses propagated from the first point to each of the obstacles, and again from these to the second point, will all arrive at the second point at the same instant (according to the second principle); and, therefore, if the hearer be at that point, his ear will at the same instant be struck by all these pulses. Now it appears that the ear can only distinguish sounds that follow each other at the rate of 9 or 10 in a second, or any slower rate, and, therefore, for a distinct perception of the direct and reflected found, there should be the interval of one-ninth of a second; but in this time, sound describes $\frac{1142}{9}$, or 127 feet nearly; and, therefore, unless the sum of the lines drawn from each obstacle to the two points, exceeds the interval between them by 127 feet, no echo will be heard at the second point. Since the several sums of the lines drawn from the obstacles to the points, are equal, it follows that the curve, passing through all the points or obstacles, will be an ellipse; therefore all the points of the obstacles which produce an echo, must be in the surface of an oblong spheroid, generated by the revolution of this ellipse round its major axis. As there may be several such spheroids of different magnitudes, it follows that there may be different echoes of the same sound; and as there may happen to be a greater number of reflecting points in the surface of an exterior spheroid, than in that of an interior, a second or third echo may be much more powerful than the first, provided that the superior number of reflected pulses propagated to the ear, be more than sufficient to compensate for the decay of sound, which arises from its being propagated through a greater space. It is not absolutely necessary that the reflecting points, producing an echo, should be accurately in the periphery of an ellipse, for if the sums of the right lines do not differ from each other by more than 127 feet, the pulse from these points will not be distinguishable. The nearer, however, these sums approach to equality, the more distinct will be the echo. From the above it appears, that for the most powerful echo, the sounding body should be in one focus of the ellipse, and the hearer in the other; but an echo, however, may be heard in other situations, as such a number of pulses may arrive at the ear at the same time, as may be sufficient to cause a distinct perception. Thus one often hears the echo of his own voice; but for this purpose he should be distant 63 or 64 feet from the reflecting obstacles. Though the first reflected pulses may produce no echo, as being too few or too rapid in their return to the ear, yet the reflecting surface may be so formed, as that the pulses which come to the ear after two or more reflections, may, after having described 127 feet or more, arrive at the ear in sufficient numbers, and so nearly at the same time, as to produce an echo, though the distance of the reflecting surface from the ear be less than the limit of echos.

[The figure generated by the revolution of an ellipse about its major axis, will not produce a perfect echo. If the sound proceed from one of the focal points, it will be reflected successively, and with the greatest force, from the two surfaces which lie in the direction of the axis; in every other direction, the sound must suffer two reflections, the first conveying it to the other focus, and the second bringing it back to the point of its departure. It is clear from the property of the ellipse, that all these twice-reflected vibrations will return simultaneously to the focus which was the point of departure; but the echo will be rendered indistinct by the interference of the simple reflections in the direction of the axis, and it will be weakened by striking two surfaces before it returns to the hearer. The most favourable position for an echo, is the centre of a hollow sphere; there, all the vibrations are reflected in the same order as in the original sound, and the echo is repeated till the imperfections of our organs render it inaudible.—Ed.]

CARNIVOROUS PLANTS.

(*From Professor Johnson's Lecture.*)

Of all the instances of sensibility in plants, the most remarkable is the *Venus's Fly-trap*. It has a large dilated foot stalk and leaf, formed of two lobes fixed by a middle rib, with some thorny processes, or protuberances, an arrangement to give it irritability. Nature provides a honey-like secretion, which attracts the flies and insects to feed upon, and by stepping on them, the leaves close, and the insect is entrapped. Mr. Knight first ascertained that this plant could be fed upon filaments of raw beef, but the general complaint is, that it will not live long in this country, from the want of a supply of its proper food. The lecturer was the first to discover that the sensibility resided in the thorns, and not in the middle rib, as was formerly supposed. After flies or any other insects are entrapped, the leaves remain closed several days, when the insect may be seen struggling within. The process will go on till both lobes of the leaf are collapsed and straight, and the teeth locked, until at last it will re-open, when the insect will be seen crushed, every particle of fluid being absorbed, so that the fly may be blown out at almost the first breath of wind. There is another plant allied to it in geographical distribution, which, when kept in a green-house, entraps beetles, flies, and other insects. At the bottom of the flower is a saccharine liquid, to which the insect goes, but cannot return, as he is arrested by what are not inaptly compared to files of bayonets. The lecturer made a series of experiments on these plants, which had been in his possession for upwards of twelve years, by feeding them with filaments of beef and mutton, and they were at last merely destroyed by accident. Another plant, a native of our own country, the *drosena rotundifolia*, or sun-dew of our marshes, possesses apparatus of an analogous organic character, bearing viscid fluid, and a multitude of hairs, which have the effect of catching insects, whereon to feed the plant.

THE CHEMIST.

CONSIDERATIONS ON CHEMICAL FORCES.

All chemical science must necessarily be founded on experiment; but the knowledge of one universal law, which enables us to foretell with certainty the result of any combination where that law is brought into action, is more important to science than the discovery of hundreds of isolated facts, which, though valuable when separately considered, may be so unconnected, and deficient in that general applicability, which should characterize the principles of every science, that they will contribute but little towards the general progress and development of philosophical chemistry. M. Gay Lussac, the celebrated French Chemist, whose reputation is almost as great as his merit, is, we are glad to find, engaged in the investigation of chemical forces, a subject of paramount and vital importance, comprising all the most remarkable phenomena of chemistry. His first memoir on this subject was read to the French Academy at the meeting of the 24th June. It is on the attraction of cohesion.

In the year 1718, a period when chemistry was still in obscurity, Geoffroy the elder attempted to class bodies according to the chemical affinities observed amongst them. He establishes the proposition, that "whenever two substances which have a disposition to join together are united, if a third substance, having a greater affinity for one of the two, be placed in contact with them, it will unite with that body; and the other, for which it has less affinity, will be abandoned." In support of this proposition, Geoffroy prepared a very simple table of the affinities of the different substances then known. It may be seen in the "Memoirs of the

Academy" for the year 1718, p. 102. It appears that, for a considerable time, little importance was attached to this table of affinities. Subjected to many perturbating causes, which frequently produced considerable variations, the effects were considered as vague, and depending upon circumstances unconnected with the properties of the bodies. But Bergman, believing that all the operations of synthetical and analytical chemistry, are founded upon attractions which cannot be denied, because they depend upon certain conditions which provoke, arrest, or disturb them, at last attracted the attention of chemists to the investigation of causes of chemical phenomena, and his dissertation on elective affinities, published in 1775, fixes a remarkable period in the history of science. Bergman distinguishes in a body the attraction of similar molecules, which he designates by the name of *attraction of aggregation;* and the attraction of heterogeneous, or dissimilar molecules, which he calls *attraction of composition.* When this attraction is exercised, so as to displace another body in a compound, it then takes the name of *simple elective attraction;* and when the action is between two compounds whose elements are reciprocally exchanged, it is called *double elective attraction.*

Notwithstanding the opinion of some chemists, that affinities are variable, Bergman appears to consider them asbsolute determined forces, but whose effects may be modified by certain causes, the influence of which he appreciates in a manner often ingenious, but sometimes very incomplete. Bergman, like Geoffroy, has not explained himself on the measure of affinities; and he did well, for it is a question of great difficulty and embarrassment even at the present day. He merely grouped bodies together by order of their greater or less affinity.

The ideas of Bergman prevailed till the period when Berthollet published his Researches upon Affinity, and Statistical Chemistry; but they were then eclipsed by the superior light of those two productions.

Berthollet, in studying the laws of affinity, has directed his attention chiefly to two circumstances, the influence of the force of cohesion in chemical phenomena, and the measure of affinities, which he thinks is to be found in the mass of the bodies which enter into combination.

According to him, cohesion, or the reciprocal attraction of similar molecules, is a powerful force, capable of balancing the affinity of heterogeneous molecules, and determining combinations and decompositions. This force he supposes to exist, not only at the moment it is manifested by its effects, but even long before it becomes effective. He demonstrates it by this analogy; when a liquid is about to assume the gaseous form, or a gas the liquid form, the expansion of the first, influenced by the gaseous state to which it is approaching, and the contraction of the second, influenced by the solid or liquid state to which it is approaching, in a progression more rapid than at a greater distance from that term.

But this reasoning of Berthollet to establish the influence of cohesion, long before its effects become manifest, is left without foundation, when we consider that there is not one constant term for the mutation of a liquid into a gas, and reciprocally; but, on the contrary, this change is incessant at all temperatures, and all pressures.

Whatever opinion may be formed of Berthollet's demonstration, it is sufficient to show that he adopted the pre-existing influence of cohesion, and considered it as an agent in all chemical precipitations and solutions.

The affinity, he says, which is capable of producing the solid state, should be considered as a force which acts, not only when solidity is effected, but even before that term; so that whenever any solid substance is produced, either by separation or combination, we must seek in the reciprocal action of the parts which acquire the solidity, the cause which produces it, although it was not previously manifested.

The theory of decomposition, by double affinity, has received unexpected improvement and support from Berthollet. To him we are indebted for the principle that the exchange of acids and bases between two salts takes place whenever the salts produced by the exchange, or only one of them, are less soluble than the given salts. This principle constitutes one of the most valuable acquisitions of chemistry; but Berthollet, in assuming the cohesion to be the first cause of decomposition, does not appear to have given the true demonstration. He supposes that the cohesion of salts not yet in existence, determines their own formation, and this supposition is inadmissible.

Bergman supposed that affinity was an absolute force, and he only established amongst bodies a relative order of affinity. Berthollet, on the contrary, believed that affinity did not act in an absolute manner; that a base, in presence of two acids, does not combine, exclusively, with the most powerful of the two, as Bergman pretended, but that it divides itself between

them, according to their affinity and their quantity. Hence the principle of Berthollet, that the affinity of different acids for the same alkaline base, is inversely proportional to the ponderable quantity of each of them, which is necessary for the neutralization of a ponderable quantity of the same alkaline base." This measure of affinity is now abandoned; the author himself, at a later period, would certainly not have proposed a mode of measuring which gives only atomic, or equivalent weight, since these are known to be independent of chemical attractions, or, at least, to be very remotely connected with them.

M. Gay Lussac commences his investigation of the influence of adhesion in the production of chemical phenomena, by examining the operation of volatilization, which appears connected with cohesion, and likely to throw some light upon the mode of influence of that force.

Suppose a volatile body presenting the solid and liquid forms within such limits of temperature as will admit of observation and experiment; take water as an example. If we determine the elastic force of its vapours, commencing at the temperature of twenty degrees below zero, at which it is solid, and possesses a great cohesion, it will be found that the progression of this elastic force is not at all affected by the passage from the solid to the liquid state, or reciprocally from the liquid state to the solid; that is to say, the elastic force of ice at zero is rigorously the same as that of water at the same temperature. This observation will apply to any other degree of the thermometer at which water may be obtained in the liquid and solid state at the same time; the elastic force of the vapour will remain the same in both cases; and, nevertheless, without its being necessary to determine the exact degree of cohesion in ice, compared with that of water, it may be admitted that it is incomparably greater. "This observation," says M. Gay Lussac, "I have verified with hydrocianic acid, which solidifies at about 15° below zero, and still preserves a great volatility. The progression of the elastic force of its vapour is not altered at the moment of its changing its state, and this result may be considered as general.

These preliminaries established, we proceed to the investigation of the effects of cohesion, and most particularly in solutions.

Among the inflammable bodies, cetine, parassine, and some solid acids, present no anomaly in their solubility in alcohol, in passing from the solid to the liquid state; the progression, as the temperature rises, is perfectly continuous and regular. Now the cohesion of these bodies, while they are solid, being greater than when they are liquid, and their solubility not being troubled, either before or after, or at the instant of their passage from one state to the other, it necessarily follows that that progression is independent of cohesion.

(To be continued.)

ON THE ANCIENT PERUVIANS.

(Extracts of a Letter from M. de Humboldt.)

LANGUAGE.

I HAVE applied also with great assiduity to the study of the American languages, and have seen how much La Condamina was at fault when he spoke of their poverty. The Carib language is profuse, beautiful, energetic, and polished; it is in no want of expression for abstract ideas; its numerical signs are sufficient to express all the possible combinations of figures. I applied in particular to the Inca language; it is generally spoken in company, and is so rich in delicate and varied phrases, that the young men, in order to say soft things to the ladies, after having exhausted all the resources of the Castilian, begin to speak Inca. These two languages, and others equally comprehensive, are sufficient to prove that America formerly possessed a greater degree of culture than was found by the Spaniards in 1492. The priests were acquainted with the method of drawing a meridian line and of observing the moment of the Solstice; and the wildest of the Indians know by tradition from their ancestors, that the moon derives its light from the sun. They also suppose the moon to be inhabited.

CROCODILES.

We have had forty or fifty young crocodiles, and I have made some curious experiments on their respiration. Other animals diminish the volume of the air in which they live, but the crocodile increases it, and can live two or three hours without breathing at all. I made the experiments on small crocodiles seven or eight inches in length; but notwithstanding this smallness of size, they are capable of cutting off a finger with their teeth, and they have the courage to attack a dog. At New Barcelona, these animals are sometimes of so peaceful a nature, that people bathe before them; but sometimes, as at New Guiana, they are so mischievous and ferocious, that during the time we were there, they devoured an Indian on the

quay in the middle of the street. At Oratuin, we saw an Indian girl, eighteen years of age, whom a crocodile seized by the arm. She had the courage to take a knife from her pocket with the other hand, and so wound the monster in the eyes, that he let her go, but cut off the arm near the shoulder. The girl's presence of mind was as astonishing as the skill displayed by the Indians, in speedily curing so dangerous a wound. One might have thought that the arm had been amputated and dressed at Paris.

FOSSIL BONES NEAR SANTA-FE.

Near Santa-Fe, there are found in the Campo de Gigante, at the height of 1370 toisés, an immense number of elephants' bones, both of the African species and of the carnivorous kind discovered near the Ohio. We caused several to be dug up, and have sent some specimens of them to the National Institute. These fossil remains have been traced from the Ohio to the Patagonians. I shall bring with me a fine collection of these bones for M. Cuvier.

E. M.

GLEANINGS.

To the Editor of the Mechanic and Chemist.

Ink.—The late Dr. Wollaston recommended the following mode of making ink: "Eight ounces of Aleppo galls, coarsely powdered; four ounces of gum Arabic; four ounces of green vitriol; a quarter of an ounce of cloves, also coarsely powdered Pour two quarts of boiling water on the galls, and stir them frequently till cold; the next day pour off three pints and a quarter of the infusion. Dissolve the gum arabic in hot water, to make half a pint of mucilage, and mix this thoroughly with the infusion. To this mixture then add the vitriol (previously di solved in hot water) and the cloves. When poured off for use, care should be taken not to disturb the sediment."

To render Ink Fluid.—All ink may be rendered fluid, by putting into it a small quantity,—that is, a piece not larger than than a pin's head,—of prepared ox-galls, which may be purchased at any artist's colour-shop.

Indian Ink.—The Chinese, or, as it is miscalled, Indian ink, has been erroneously supposed to consist of the secretion of a species of cuttle-fish. It is, however, all manufactured from lamp-black and gluten, with the addition of a little musk, to give it more agreeable odour.—*Davis.*

Query, What is the process of making this ink?

The Chinese affect to despise European ingenuity, but they cannot mend a common watch; when it is out of order, they say it is dead, and barter it away for a living one. T. C. D.

New Jerusalem Church Free School, Charles Street, Westminster Road.—The Seventeenth anniversary of the above Institution took place at the Horns Tavern, Kennington, on Wednesday, the 3rd inst. The children, 500 in number, were liberally regaled on the common, during the afternoon, with cake, fruit, &c.: they excited the admiration of numerous persons collected on the spot, by their neat and healthy appearance. About 150 of the Subscribers and friends to the School sat down to tea in the long room of the tavern. The Reports of the Secretary and Treasurer were very satisfactory, and the excellent manner in which the children went through a sort of vocal concert, illustrative of a new system of instruction introduced in the School, gave great satisfaction to the meeting, and drew forth long and reiterated bursts of applause. Several excellent speeches were made, and liberal donations announced, and the company separated at a late hour, highly gratified, and deeply impressed with the pleasing spectacle they had witnessed.

To Read the Inscription that has been erased from a Coin.—When such a coin is laid upon a red-hot iron, the letters and figures that have been either wholly obliterated, or obliterated to such a degree as to be illegible, become oxidated, or rusted; and the film of oxide radiating more powerfully than the rest of the coin, the illegible inscription may be now distinctly read, to the great surprise of an observer who had previously examined the blank surface of the coin. In order to explain the cause of this remarkable phenomenon, it is necessary to notice a method, that has been long known, of deciphering the inscriptions on worn-out coins. This is done by merely placing the coin upon a hot iron; an oxidation takes place over the whole surface of the coin, the film of oxide changing its tint with the intensity or continuance of the heat. The parts, however, where the letters of the inscription had existed, oxidate at a different rate from the surrounding parts; so that these letters exhibit their shape, and become legible, in consequence of the film of oxide which covers them having a different thickness, and therefore reflecting a different tint from that of the surrouding parts. The tints thus developed

sometimes pass through many orders of brilliant colours—particularly *pink* and *green*, and settle in a bronze, and sometimes a black tint, resting upon the inscription alone. When the experiment is often repeated, the coin loses its property of becoming luminous in this way, but regains it on being exposed for a time to the atmosphere. The reason that the parts of a coin, that has been roughed by an acid, become more luminous than the parts that are left in a polished state, is, because all rough and black surfaces radiate light more copiously than polished and smooth surfaces; and hence the inscription is luminous when it is rough, and obscure when it is polished.—*Dalton's Book of Experiments.*

Method of procuring Animalcules to make Examinations.—In the selection of vegetable substances for infusions, such as stalks, leaves, flowers, seeds of plants, &c., care must be taken that there be no admixture of quinine in them, or the intention will be frustrated. Immerse these, whatever they may be, for a few days in some clear water, when, if the vessels which contain them be not agitated, a thin pellicle, or film, will be discerned on the surface, which, under the microscope, will be seen to be inhabited by several descriptions of animalcules; the first produce is generally of the simplest kind, such as the monads. In a few days more, their numbers will increase to such an amazing extent, that it would be utterly impossible to compute those in a single drop of the fluid. They will afterwards diminish in numbers, and then be supplanted by others of a larger species and more perfect organisation. If the vessel be large, and under favourable circumstances, a still higher description of animalcules will succeed; and thus a single infusion will repay for the little trouble of making it, with a great variety of species. Flour steeped in water will also abound with animalcules. Next make infusions of the flesh of different animals, and after remaining some days in close glasses, you will have the pleasure of seeing organic moving particles in all of them. Some appear sooner, others later; some preserve their motion for months, others soon lose it. Some at first produce large moving globules, resembling animals, which change their figure, split, and become gradually smaller; others produce very small globules, whose motions are extremely rapid, and others produce filaments which grow larger, vegetate, and then swell, and pour forth torrents of moving globules.—*Pritchard's Nat. Hist. of Animalcules.*

Origin of the Art of Paper-making.—The origin of the art of paper-making is involved in considerable obscurity, but from the closest investigations into the subject by antiquaries, it would appear it was known and practised in China upwards of two thousand years ago. From China it is said to have found its way into Persia, from Persia to Arabia, and from Arabia to Spain, into which it was introduced by the Moors. From Spain, the knowledge of the art spread to France about the year 1260, to Germany in 1312; and it is known to have been in England in the year 1320. The Chinese made their paper of silk or bamboo reduced to a pulp; the Arabs did not follow this practice, but formed their paper of cotton, and the Spaniards were the first who tried the process with linen substances.—*Cyclopœdia.*

To make a Solar Magic Lantern.—Make a box a foot high, eighteen inches wide, and three inches deep, two of the opposite sides of this box must be quite open, and in each of the other sides let there be a groove wide enough to admit a stiff paper or paste-board; you then fasten the box against a window on which the sun's rays fall direct; the rest of the window should be closed up, so that no light may enter. Next provide several sheets of stiff paper, blacked on one side; on these papers cut out such figures as your fancy dictate; place them alternately in the grooves of the box, with their black sides towards you, and look at them with a clear glass prism, and if the light be strong, they will appear painted with the most lively colours. If you cut on one of these papers the form of a rainbow about three quarters of an inch wide, you will have a very good representation of the natural one. HEJE.

To convert Two Liquids into a Solid Mass.—If a saturated solution of muriate of lime be mixed wtth a saturated solution of carbonate of potass (both liquids), the result is the formation of an opaque and almost solid mass. If a little nitric acid be added to the product, the solid mass will be changed into a transparent liquid.

Discovery of Caverns in Devon.—A curious discovery of a range of caverns was made last week in Chudleigh Rock, in consequence of a terrier dog getting into a fissure in pursuit of a rabbit. The dog was heard at various times to bark for more than a week, and as it was almost impossible to extricate him, it was attempted to destroy him by burning brimstone. On the fifteenth day after the dog's entombment, his moans were plainly heard by many persons, when a further endeavour was made in vain to extricate him. A lad on the following day had the courage, with a rope affixed to him, and two lanterns, to enter the chasms, and after two hours, working a passage of twenty feet, he descended into a dry chamber, about thirty feet square, and sixty-three feet below the opening, where he found the dog dead, but still warm. From an aperture in this cavern gushed a stream of air leading into

another cavern, which is supposed to be still deeper, as the boy had not rope enough to descend. This range of caverns is beneath those where Professor Buckland many years since discovered some extraordinary antediluvian remains. —*Exeter Gazette.*

Advantage of Snuffing Candles.—A good wax candle, properly snuffed, and burning with a clear bright flame, consumes 100 parts in weight; a good tallow candle, burning under the same circumstances, consumes 101; but a similar tallow candle, burning very dim from the want of snuffing, consumes 229; so that the consumption of more than double the quantity of combustible matter yielded less light. This latter circumstance proves the advantage of snuffing candles frequently, both as regards the quantity of light and the economy of the practice.—*Count Rumford.*

Comparative Powers of Men, Horses, Engines, &c.—The common labourer may be said to employ a force capable of raising a weight of ten feet in a second, and continued for ten hours a day. A moderate horizontal weight for a strong porter, walking at the rate of three miles an hour, is two hundred pounds. The chairman walks four miles an hour, and carries one hundred and fifty pounds. The daily work of a horse is equal to that of five or six men upon a plane, but from his horizontal figure, if drawing up a steep ascent, it does not exceed the power of three or four men. In working windmills, twenty-five square feet of the sails is equivalent to the work of a single labourer; and a full-sized mill, provided it could be made to work eight hours a-day, would be equal to the daily labour of twenty-four men. A steam-engine of the best construction, with a thirty-six inch cylinder, has the force of forty horses, or of six hundred men daily, every square inch of the piston being equal to the power of a labourer.—*Edinb. Journ.*

National Physical Force of Animals.—The following interesting account is given by M. Dupin of the physical force of the animals of France:—The whole animal force of the kingdom is only equal to four times the physical force of the people; while in Britain, the whole animal is equal to eleven times the physical force of the people; whence it follows, that in France the labourers are three times less assisted by animals than the labourers of Britain. In Britain, they have one horse for every ten inhabitants; in France, one for every 30. The diligences, or stage-coaches, except on a few roads, travel at the rate of only two leagues an hour, while in England, the same conveyances travel at the rate of three and even four.—*Ibid.*

Husks of Grapes.—The husks of grapes, deprived by distillation of their alcohol, have been found an excellent substitute for oak bark. The skins being prepared in the usual manner, they are thrown into the pit, and they are covered with the husks. From 35 to 45 days are sufficient to complete the tanning. E. J. S.

Simple way to produce Flame under Water.—Take a bit of the metallic potassium; throw it on a piece of ice, or a little water, and it will burst into a beautiful blue flame.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, July 17, R. Adams, Esq., on Chemistry. Friday, July 19, W. H. Stoker, Esq., on Music. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Wednesday, July 17, Quarterly General Meeting. At half-past Eight o'clock.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, July 16, P. E. Dove, Esq., on the Hisrory of the Spanish Inquisition. At a quarter to nine.

QUERIES.

1. How to make powder gold? 2. How to make plate powder? 3. How to prepare the skeletons of small animals in the quickest manner? 4. Where I can purchase a retort for distilling mercury held in combination with other metals, such as tin on the backs of looking-glasses? 5. What is the best test for distinguishing palladium from platinum? 6. How to dissolve India-rubber so as to *dry quickly*; also the way to make catheters, and India-rubber balls? I have succeeded in dissolving the above in spirits of turpentine, but it takes a long time to dry. Naptha does not answer the purpose? P. T.

Whether an expansive engine works upon the high-pressure principal or condensing? And how to make an high-pressure engine work upon that principal, and if I can make one work at all? YOUNG ENGINEER.

1. How are dark spots, &c., removed from lacquered work previously to relacquering? 2. What sort of lacquer is it that forms the pale colour, and how are the brilliant parts of the work produced? 3. What is the proper sort of varnish for gold frames? W. J.

1. How to set out the teeth of wheels? 2. Whether the teeth of wheels are cast with the wheel, or whether they are cut afterwards? 3. Where can the sand used by founders be bought, and also what sort? 4. Which is the best and cheapest practical work on the teeth of wheels? 5. Can you give me a description of a machine for making spring wire, such as is used for gaiters? 6. How spiral screws are cut in a lathe? A MECHANIC.

How to make diamine ink, and also at the same time, whether I could, or could not, make ink of the same description into different colours? N. CARTER.

How to make old oak the colour of new, or new the colour of old? J. T.

ANSWERS TO QUERIES.

To Dye Hair Black.—Take of silver, 2 ounces; steel filings, 4 drachms; nitric acid, 1 ounce; rain water, half a pint; let this stand 48 hours,

and pour off the clear liquor: this the dye. It is not a depilatory, and should be applied with a close hair pencil. The preparation which I mostly use, is the following :—Carbonate of lead, 1 ounce; litharge, 1 ounce; unslaked lime, 2 ounces; rub them finely together. When it is to be used, rub it into a paste with water, and apply it to the hair at night. Wear tinfoil over it till the morning. This does not discolour the skin or destroy the hair. W. W. R.

To Bronze Plaster of Paris Figures.—Lay the figure over with isinglass size, until it holds out, or without any part of the surface becoming dry, then with a painter's sash tool go over the whole, taking care to remove, while soft, any of the size that may lodge in the delicate parts of the figure. When dry, take a little very thin oil gold size, and with as much as will just damp the brush, go over the figure with it, allowing no more to remain than causes it to shine. Set it aside in a dry place free from smoke, in 48 hours the figure is prepared to receive the bronze, which must be dabbed on with cotton wool. After touching the whole figure, let it stand one day, then with a soft dry brush rub off the loose powder, particularly the prominent parts of the figure; it is then finished. P. T.

To fill Decayed Teeth.—Take the white of an egg, diluted with the same quantity of white lead, when the mastic appears sufficiently hard to keep within the tooth, it must then be filled, and care must be taken to clean the adjoining parts, so that no portion of the composition be swallowed. This should be done at night before going to bed, because the mastic has the advantage of the night to harden itself within the tooth, which is a great and essential circumstance. Care must also be taken the next day, not to eat on that side where the mastic has been placed, in order that it may not fall out before it has hardened itself.

W. G. A. H.

To Harden Steel for Magnets.—Make it a white heat, in a charcoal fire, and suddenly immerse it in olive oil. I have found the above answer very well, but if any of your correspondents know any better way, I shall feel obliged by their naming it.

To Cast Zinc Plates and Rods for Galvanic Batteries.—He should have a well-made iron or brass mould; some cast them in sand, but that will not do, because it makes them rough, and they should be smooth. There is a shop in Wardour-street, near Oxford-street, where they can be bought ready cast. AN AMATEUR.

Zincography.—The principle and most of the practice of the art, is the same as lithography, except that plates of zinc are used instead of stones, as the name implies. At present its practice is not very perfectly known, but it is now becoming rather general. The great difference between the two, and, indeed, the essential point, is the zinc being more susceptible of grease than stone; the drawings require to undergo a different process. In preparing a drawing on zinc, instead of etching it with acid, a liquid is used, the composition of which at present is a secret known only by very few; for the manufacture of which, I believe a patent was taken out a few years since by a person named Chapman. I think it can be purchased of Mr. Grieve, in Nicholas-lane, Lombard-street. For me to give a detailed account of the process of lithography, would intrude too much upon your limited space; to those of your readers who desire to obtain a knowledge of the art, I should recommend them to attend the lectures published to be delivered by Mr. Bowles on lithography. at the Mechanics' Institution, Southampton-buildings, in August next.

R. H. L.

"William Conquest" may purchase a book on painting at Mr. William's Library of Arts, Great Russel-street, Bloomsbury; and also at the same time time, books on the principles of architecture, at moderate prices.

FREDERICK JAMES.

TO CORRESPONDENTS.

D. H. *will find the information he requires in our present Number, Rainbows are constantly seen when the sun shines upon great cataracts; and they may at any time (when the sun is out) be artificially produced by projecting water in the air, so that it shall descend in small particles like rain. A complete circle would be seen if the earth did not intercept the rain and the sun's rays below.*

A Correspondent, *who has adopted the very unaspiring cognomen, "A Fool," has sent us a drawing and description of a "new level;" the direction of the plumb line, and, consequently, the position of the surface to be levelled (with respect to the horizon) is to be shown by a black spot under the weight, so that it may be seen at one view whether the surface be horizontal in every direction. We consider it less convenient and less accurate than a properly-adjusted spirit level.*

G. T. F. G.—*Glass may be cut into any required form without the use of a diamond, by the following process:—suppose the article to be operated upon be a glass goblet, and it is required to cut it spirally, so as to form a spiral spring; make a part of the rim hot by holding it in the flame of a candle, and then apply a wet finger to it, and a small crack will appear; then take a red-hot iron, or the tube of a common tobacco pipe (which latter is preferred by watch-glass makers), and pass it over the glass in the line you wish to cut; the crack will follow the hot pipe wherever you choose to lead it.*

N. P. B. *must apply to Mr. Parker, No. 4, Greenland-buildings, Tabernacle-walk, Finsbury, or to W. M. Dawes, 131, Upper-street, Islington.*

The commencement of the history of the London and Birmingham Railway will appear next week.

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THE

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THE LONDON AND BIRMINGHAM RAILWAY.

ENTRANCE AT EUSTON GROVE.

FIG. 1.

HARROW ON THE HILL.

FIG. II.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

The intense interest created at the first introduction of steam locomotion on railways, not only in this country, but throughout the civilized world, still accompanies its progress; and the mind has scarcely ceased to be dazzled by the contemplation of the brilliant success of the first great experiment on the Liverpool and Manchester line, when still mightier works are undertaken, and many of them already accomplished, both in Europe, and in America.

The limits of this brief sketch will not permit us to investigate the claims of the numerous aspirants to the honour of invention, or even to enumerate the authors whose labours, from the time of Hiero, before the commencement of the Christian era, to the present day, have contributed towards the completion of the present triumphant system of steam locomotion. We therefore proceed, without further introduction, to give a concise, but accurate history and description of one of the most potent of the innumerable arms of "the giant Atmos"—the London and Birmingham Railway.

A railway from London to Birmingham was projected so long ago as 1825; but owing, probably, to the financial panic of that year, it was abandoned till 1830, when two schemes were simultaneously formed to carry the project into effect. In September of the same year, it was agreed that the two companies should unite, and apply to Parliament for the necessary powers to execute the work. It was at first proposed that the railway should contain four lines of rails, and it was intended to pass through Grove and Cashiobury Parks, near Watford, following the line of the Grand Junction Canal; this desirable line, it was, however, found necessary, or at least expedient, to abandon, owing to the obstinate opposition of the Earls of Essex and Clarendon, through whose grounds it would have passed. Rather than encounter the delay, expense, and even danger of ultimate defeat, to which the opposition of those noblemen would have exposed them, it was resolved to adopt another line which required a tunnel more than a mile in length, causing an immense increase of expenditure to the company, and inconvenience much complained of by the public. It is an example of singular inconsistency, that the Grand Junction Canal is allowed to pass through each of the parks, bringing with the barges a set of men whose ruffianly habits are constantly revealed before the magistrates, or recorded in the criminal courts; and yet the same persons who submit to this without murmuring, have impeded, and permanently injured, a great national work, which would neither have intruded on their privacy, nor have caused any other inconvenience, than the appropriation of a certain portion of land which would have been very amply paid for.

On the 31st of January, 1832, the Board of Directors having obtained more accurate information respecting the country through which the line of road was to pass, and having re-modelled their plan accordingly, and reduced the railway to two lines of rails instead of four, as was at first proposed, issued a circular declaring their intention to go to Parliament immediately; and on the 20th of February following, their bill was read a first time in the House of Commons. On the 28th it was read a second time, and there appeared a majority in its favour of 125 to 46. On the 21st of June, the committee, after a rigorous examination of evidence, voted the preamble by a majority of 26 to 10. When the report was brought up, a few members considered it their duty to exert all the influence they possessed, to deprive the nation of the benefit of this magnificent enterprize; but their cause, their motives, their arguments, and fortunately their numbers, were alike contemptible; and the majority against them was so overwhelming, that they did not divide upon the motion they had brought forward, for the purpose of harassing the company by further delay. The bill then went up to the Lords, and was committed on the 22nd of June. In the committee of the Lords, the opponents of the bill prevailed; and on the 10th of July it was lost in committee.

The directors, although defeated, were determined to persevere: on the Friday succeeding the loss of the bill, a meeting was held at the Thatched House Tavern, at which Lord Wharncliffe, the president of the Lords' committee, presided. The result of that meeting was the following resolutions:

1st. That, in the opinion of this meeting, a railway from London to Birmingham will be productive of very great national benefit.

2nd. That the bill effecting this important object having passed the House of Commons, after a long and vigorous examination of its merits, it must be presumed that its failure in the House of Lords has arisen from apprehensions on the part of landholders and proprietors

respecting its probable effect on the estates, which this meeting firmly and conscientiously believe to be unfounded.

3rd. That consequently this meeting see no parliamentary or other other ground for abandoning this great undertaking, convinced as they are, that by timely explanations, and a continuance of judicious management, the difficulties which occurred in the progress of the bill, may be removed in the ensuing session of Parliament.

Notwithstanding the disastrous termination of the late proceedings in Parliament, and the expenditure of nearly £32,000, the directors, encouraged by the favourable result of this important meeting, determined to apply again to Parliament, and acordingly introduced a bill, which was passed on the 6th of May, 1833. The enormous sum of upwards of £50,000 had by this time been expended, chiefly in contending against a selfish, anti social, anti-national, and vexatious opposition.

It was not, however, till the month of March, 1834, Mr. Robert Stephenson being appointed chief engineer, that contracts were entered into for the first twenty miles of ground, and in the following June operations commenced.

On the 3rd of July, 1835, another act was passed to extend the railway to Euston Grove, which was speedily carried into effect. This, and other great objects not contemplated in the original estimate of £2,500,000, caused an expenditure far exceeding that amount. It is probable that the whole capital sunk in the undertaking, will not be less than three times the sum at first proposed.

On the 17th of September, 1838, after encountering and overcoming the most tremendous difficulties, the company were enabled to open the railway for public conveyance, throughout its entire length.

At the London *terminus* (or termination) the entrance is through a magnificent structure in the doric style of architecture, a correct representation of which is given in fig. 1, front page. The height to the top of the pediment, is seventy feet. The station within contains the offices and buildings required for passenger traffic, and occupies an area of seven acres. The station for the merchandize department is situated at the north side of Park-street, Camden-town; it contains extensive buildings for engines, waggons, merchandize, &c., and covers about 33 acres of land. The connexion between the two stations is through a cutting twenty feet deep, and walled on both sides. The distance is about a mile and a quarter, and forms an inclined plane, rising from Euston Grove to Camden Town. The trains of carriages, on their departure from London, are drawn up by an endless rope, which runs round cylinders, set in motion by two stationary engines of sixty-horse power. This rope is 10,950 feet in length, nearly two inches and a-half in diameter, and weighs about eleven tons and a-half; it is supported on the road by iron sheaves, hollowed out on the edge to receive the rope, and turning in iron frames in the manner of a pulley. These sheaves are placed at distances of twenty-four feet. On the arrival of the trains in London, they descend this inclined plane by the continued effect of the impulse previously communicated to them, assisted by the force of gravity during the descent. The rise of the plane varies from 1 in 66, to 1 in 132. The remaining part of the journey is performed by means of locomotive engines. At a short distance from Camden Town is the entrance to the Primrose Hill tunnel, which is 1120 yards long, twenty-two feet high, and twenty two feet in breadth. There are five capacious shafts placed at equal distances, for the purpose of ventilation. Three miles farther on, at Kensal Green, is another tunnel, 320 yards long. Crossing the river Brent, by a viaduct of seven arches, the road passes near to Harrow, a small town on a hill, ten miles N. W. from London, and situated on the highest ground in Middlesex. A view of this delighful spot is given in engraving (fig. 2). Harrow is a town of great antiquity, but chiefly celebrated for its free grammar school; it was founded and endowed by John Lyon, in the reign of Queen Elizabeth. In the time of the Saxons, the manor of Harrow, (which is designated in ancient records by the different appelations "*Herges*," "*Harene alte Hulle*," or "*Herga super Montem*,"*) belonged to the Church of Canterbury. It was taken from that Church by Kenulf, King of Mercia, but recovered by Archbishop Wilfred in the year 822, and remained in the possession of his successors, until Henry VIII. exchanged it with Archbishop Cranmer for other lands. It afterwards came into the family of Rushout, and the manor house is still in the possession of that family. The hill, which rises from a rich valley, affords a variety of beautiful and extensive prospects. The

* According to some authors, the first signifies an *army* or *encampment;* but others contend that it is a corruption of the Saxon word "*Herige*," a church. The two latter signify "*Harrow on the Hill*," by which name it is at present known.

view towards the east is terminated by the domes, spires, chimnies, and smoke, of the greatest city in the world; to the south, by the Surrey Hills. Towards the north, the view is intercepted by the high ground about Stanmore and Harrow Weald. On this side may be seen the village of Stanmore and Bentley Priory, the seat of the Marquis of Abercorn. The prospect towards the west and south-west, is very extensive; it may be seen to the greatest advantage from the church-yard. This view embraces Windsor Castle, and a great extent of country in Berks and Bucks.

The manor house, called "Harrow Park," is in the style of the time of James the First, and at present occupied by one of the functionaries of the Grammar School.

The church, "if they have writ their annals true," was founded by Archbishop Lanfranc about the time of the Norman Conquest. It has a lofty and graceful spire, covered with lead: some part of the original fabric still remains, and the remainder was built about the fourteenth century. But the object of the greatest attraction is the Free Grammar School before mentioned, founded by John Lyon, a farmer in the parish, in 1571. It is a brick building, situated on the same eminence as the church. The original school room is lined with oak pannels; which, together with the desks, forms, &c., are literally covered with cuts and carvings of names. That of Byron is carelessly executed, but Sir Robert Peel has evidently taken much pains to "make a good job" of his. The names of Sheridan, Spencer Percival, Lord Palmerston, and many other persons who have since risen to eminence, are inscribed in this room: but while we admire the nursery of genius where the young intellect is fostered, and nourished with the invigorating aliment of learning, a painful reflection will intrude itself upon every thinking mind,—amongst the thousands of names recorded in this room, scarcely one can be discovered, which does not belong to some opulent family, and parents quite able to provide ample education for their children without the assistance of an institution originally intended for the now disinherited class of poor, but deserving persons. In 18"9, some of the parishoners of Harrow made an application to the Court of Chancery for the recovery of their rights. In 1810 judgment was pronounced, which was, of course, in favour of the school as at present constituted.

There is an exceedingly silly anecdote connected with Harrow, which seems to show that the king's name is not only "a tower of strength," but "a mine of wit;" it is related of Charles the Second (and the circumstance is repeated in almost every history that gives a description of Harrow), that being present at a theological dispute concerning "the visible church," he observed that the visible church must be the church of Harrow-on-the-Hill, because that object is seen from a great distance. If any person of "low degree" had made this pun, it would scarcely have elicited a transient smile; but it proceeded from a king, and therefore must be chronicled and preserved for the edification of all nations to the latest posterity. Harrow is remarkable in history, as the place of retreat of Anthony Babington, the chief of "the Babington plot," in the reign of Queen Elizabeth. He was arrested at this place, and taken to London, where he was executed, together with his accomplices, being found guilty of conspiring with Mary Queen of Scots, to murder Queen Elizabeth.

The Harrow station is $11\frac{1}{2}$ miles from London, and $100\frac{3}{4}$ from Birmingham. It is not a stopping-place for the principal trains, being only an intermediate station; there are some trains which call here, but the hour of their departure for London varies with the season.

At a short distance from the Harrow station, commences an excavation, three quarters of a mile in length, and in some parts from twelve to fifteen feet deep. A little further on, there is another excavation, a mile and a half in length, and in some places from thirty to forty feet deep. Upwards of 370,000 cubic yards of earth were removed from the cutting. At the termination of this excavation, commences an embankment (in the county of Herts) three quarters of a mile in length, and in some parts thirty feet high. 150,000 cubic yards of earth were required in its formation. Beyond this embankment the railway is level for a little more than a mile; after which comes a descent for about the same distance, commencing at the ratio of 1 in 440, which about half way is reduced to 1 in 528. An ascent of 1 in 406 for one mile and three quarters then commences, and is followed by another ascent of 1 in 1056 for about a mile and a half further. The ascent then becomes more rapid, being 1 in 528 for three miles and a half, and 1 in 330 for seven miles and a half, which leads to Tring summit, 330 feet above the station at Euston Grove. About two miles more

from the fifteenth mile post, is More Park, one of the most magnificent mansions in the country; it is built of Portland stone, and the doorways are of marble; both the interior and exterior are profusely decorated, and it is surrounded by a park five miles in circumference. It has been successively inhabited by many eminent personages; in the reign of Henry VI. it was the residence of Neville, Archbishop of York; it was afterwards occupied by Cardinal Wolsey, the Duke of Monmouth (son of Charles the Second), and Lord Anson; it is now the residence of the Marquis of Westminster. To the right is the village of Watford Heath, and Sherrard Wood. A little farther on there is an excavation of half a mile; it is 41 feet deep, and nearly 500,000 cubic yards of earth were taken out of it. A little beyond this excavation is Watford Heath Bridge; after which an embankment commences, one mile and a half in length, and in some places 42 feet high. It required nearly one million cubic yards of earth. About 50 yards from the commencement of this embankment there is a viaduct of five arches, which carries the line over the London road, and the river Colne. After passing over another viaduct of five arches, a view of Watford is obtained on the left; and at 17¾ miles is the Watford station and bridge over the St. Alban's and Rickmansworth road.

(*To be continued.*)

RAILWAY CURVES.

To the Editor of the Mechanic and Chemist.

Sir,—I have observed with much pain the many accidents that have lately occurred in railway travelling, and the odium in which it is held. I wish to make a few remarks to remove that odium, and to call the attention of railway proprietors to the defective method of railway engineering. I will take for example the Eastern Counties' Railway, on which an accident occurred lately, and was noticed in your pages.

1st. *The Railway.* This railway abounds in curves, and some of a very short radius.

2nd. *The Engines.* The engines used on this railway were manufactured by Mr. Braithwait, the Company's engineer, and have four wheels; the axles of these wheels are firmly fixed at right angles to the railway, and parallel to each other. Now engines of this construction will always endeavour to run in a straight line; but the railway abounding in curves, the engine will either strain itself very much, or the rails will be wrenched from their chairs. If neither of these effects occur, the engine will run off the rails, as was the case in the late accident. Now I will endeavour to point out a remedy for these defects. The railway cannot be altered, but the engines might be so constructed, as to run safely on the rails. The axle of the two running wheels might be allowed to have play by means of a pivot passing through its centre, so as to allow the wheels to fit the rails in whatever curve it may have to traverse, and all the engines should be provided with a sweep, to sweep the stones or rubbish that persons or accident might throw on the rails. The crank-axle should also be balanced to prevent rocking or swaying from side to side, as may be seen when riding in the carriages. In the case of a meeting on the same line of rails, might not the engine be made to carry a small length of flexible railway to run on the other rails, and thus avoid a concussion. I am not mechanic enough to give a plan how they might be done, but I should think, among the thousands of mechanical men that read your valuable magazine, such a plan might be provided. Now when the evils that I have enumerated may be avoided by such contrivances, is it not injudicious on the part of railway proprietors, to sacrifice property and life in the manner that is done? The railway proprietors suffer very much, as well as the public, on the occurrence of any accident, for engine work is very expensive, to say nothing of the provision there must be made to persons hurt or killed. I say, when such can be avoided by such simple means as I have pointed out, it ought not to be left to the option of the railway proprietors, but the strong arm of the law ought to compel them to adopt such contrivances, by levying a heavy deodand on the engineer or railway causing such accident; for it is plain, with a well-formed railway, and properly constructed engines, no accident could occur, were the engines driven at the highest possible speed.

I remain yours truly,

D. J.

[One of the great objects achieved by steam locomotion, is the comparative security from accident which it offers to travellers. If we were to say that there are a hundred chances of a passenger suffering injury through accident in a common stage-coach, to one in a railway train, we should probably speak less favourably of the latter conveyance, than experience would justify; but no one can deny that bad curves should be avoided, even at a

great sacrifice. Since the engine constantly endeavours to proceed in a direct line, it is evident that, when moving in a curve, it is inclined to pass over the outward rail; this tendency might be lessened in some degree, by deviating a very little from the horizontal line in the section of the rails; that is, the outer rail being rather higher than the inner. The plan proposed by our correspondent would cause great inconvenience, by affecting the stability of the engine; but the best, and perhaps the only effectual remedy, is that which every one is aware of—to make no bad curves under any circumstacces whatever.—Ed.]

FRENCH AND ENGLISH MEASURES.

ON THE FRENCH METRE.

To the Editor of the Mechanic and Chemist.

Sir,—Wishing, if possible, to settle the question of the metre, I send you the following values of that measure, which I have either extracted or calculated from the different cyclopœdias and authorities mentioned below. In doing so, I think it proper to mention, that I have referred my equations to the quantity given by Delambre, viz., 3.078414 French feet, which is, I believe, the one used in the military schools of France.

	Feet.
Ency. Brittan.	3.2877773
N. Amer. Rev.	3.2813334
Dr. Duncan; Barlow	3.2809167
Kater..............	3.2808992
Ency. Americana ...	Same.
Annuaire (1838)	Same.
Penny Cyc.	3.2808989
Ency. Méthodique ..	3.2808695
Bonnycastle	3.2808500
La Croix	3.2805073
Partington's Cyc. ...	3.1980000

It will be noticed, that Captain Kater's value, which is said to have been taken with great care, exactly agrees with the "Mechanic" and "Silliman's Journal." In conclusion, I would particularly call the attention of your readers to the important fact, that the difference between the highest and lowest of the values I have sent you, is upwards of one inch.

I am, Sir, yours truly,

C—s C—r.

[The quantity quoted from Partington's Cyclopœdia, is unquestionably incorrect; if we exclude the results obtained from compiled works, which cannot be considered as authorities in their own right, it will appear that the difference between the highest and lowest values of the five results in the above list, which are supported by the names of authors, is only .0008261 feet, or $\frac{1}{000}$ of an inch (nearly); the difference between the value which we have adopted, and the greatest in the list (Amer), is .0004342 feet, or not quite $\frac{1}{999}$ of an inch; the difference between the same quantity and the least (that given by La Croix), is .0003919 feet, not quite $\frac{1}{212}$ of an inch. The average of the whole five is 3.28090132, which differs from ours (3.2108992) by only .00000212, or $\frac{4}{155503}$ of an inch. If we add to this near approximation, which is rendered still more satisfactory by the circumstance of its being nearly a mean between the two extremes, that it is supported by the authority of the *Annuaire*, a work published under the superintendence of M. Arago, and chiefly written by him, we feel persuaded that our much-esteemed correspondent will agree with us, that 3.2808992, is the nearest approximation hitherto obtained to the value of the French metre, in English feet.—Ed.]

WOOD PAVEMENT.

EXPERIMENT IN OXFORD-STREET.

After a trial of seven months in one of the greatest thoroughfares in London (the lower end of Oxford-street), the wood pavement remains unimpaired; some specimens of asphaltum (a mixture of something like coblers' wax and sand) have also resisted; but next to the granite stones, the wood seems best to stand the test. This wood paving is by no means a new invention; the Broadway at New York has been paved in that manner for many years, and has supported a traffic not much inferior to that of Oxford Street. The city of St. Petersburgh has long been paved with wood cut into hexagons, or six-sided blocks, similar to those employed in America, and in the present experiment in London. At the latter part of the last century, the city of Tobolsk, in Siberia, is described by Kotzebue as being "paved, or rather floored, with wood." But till its introduction into this country, wood has only been employed as an economical substitute for the more durable material, stone, in woody countries where good stone is scarce.

We have seen some parties concerned in repairing some of the principal streets

of the metropolis, and they seem quite confident that after a year or two, the blocks of wood will be replaced by granite stones – time will show.

On Saturday, at a meeting of the Mary-lebone vestry. Mr. Salomons called the attention of the vestry to the subject of the experimental pavement in Oxford-street; he had read in the country papers, paragraphs announcing from time to time the failures of the various plans. Amongst them on a late occasion, it was asserted that the wooden blocks had also given way, and turned out to be a failure. Under these circumstances, he called for an explanation from the vestry if such were the case, and whether the committee had made any report upon the subject, as he thought it was hardly fair that such statements should be put forth, before the various designs had been fairly tested.

The surveyor, Mr. Scaice, being called in,

Mr. Salomons inquired whether there was any decay or inequality on that portion of the paving of Oxford-street, composed of wooden block ?—Mr. Scaice said there was not the least symptom of decay that he was aware of, in fact, there was no sensible alteration to indicate its failure. It, however, would at times become more rough than others, in consequence of the change of the weather.

Mr. Kensett said it would be unfair to let this *ex parte* statement go forth to the world without letting the public know what condition the other experiments were in. He would, therefore, put the question to the surveyor as to their condition.—Mr. Scaice replied, that the specimens remaining, which were the Gaugac bitumen, Claridge's asphalte, and the Val de Travers, were in equal preservation to the wood, and had exhibited as little symptoms of decay.

Mr. Hope wished to know how long the wooden pavement had been down in the road.—Mr. Scaice replied, nearly seven months.

URANIAN SOCIETY.

July 9th, 1839.

W. H. White, M.B.S., S.M.S. in the Chair.

The minutes of the preliminary meeting were read and confirmed. Several gentlemen added their names as original members, and Professor Hague, Philadelphia U. S., was admitted an associate.

The Chairman then read a very interesting paper on the supposed connection between *astronomy and meteorology*, which led to a very animated discussion. The chairman's paper was considered eminently calculated to open new views of astronomy, by showing whether the heavenly bodies have any influence upon the earth's atmosphere, and thereby to produce a more extended usefulness of astronomical knowledge. This interesting paper was concluded by a series of questions for discus ion at future meetings. The first of which was selected, viz. " Is the sun the cause of heat, cold, dryness, &c.; and if so, in what way is his influence exerted upon the earth's atmosphere ?" For discussion on the first Tuesday in August, at eight p.m. Lovers of science are cordially invited to attend this discussion. Tickets may be obtained of the hon. secretary, J. M. Cuvulie, Esq., or of the secretary of the Meteorological Society, 25, Bartlett's Buildings, Holborn.

REVIEW.

The London and Southamption Railway Companion. By Arthur Freeling. London : J. T. Norris, 138, Aldersgate-street.

This work is got up in the same admirable style as that of Mr. Freeling's preceding Railway guides, the practical use of which to every person choosing this speedy mode of transit, is unquestionable. We avail ourselves of an extract: —

"After clearing the excavation, we quickly arrive at one of the most interesting spots upon the line, it is Old Basing, with its most beautiful church and the remains of its once proud castle, both are admirably seen from the embankment upon which we are travelling. Old Basing was, during the Saxon dynasty, a place of much more importance than Basingstoke, the termination of the latter being in fact a declaration of inferiority; *Stoke* in the Saxon signifying a hamlet. This place was the site of a bloody battle between the Danes and the Saxons under Ethelred, assisted by his brother Alfred, not then twenty years of age, in which the latter sustained a defeat ; it became however more eminent from the memorable siege of its castle, which was held for the King by John Paulet Marquis of Winchester, a lineal descendant of Hugh de Port; and also in a direct line from Sir William Paulet, Knt., created Marquis of Winchester by Edward the Sixth, and considered one of the most gallant knights and "most polite gentlemen of the age." It appears from a survey made in the year 1798, that

the fortress and its out-works occupied an area of about fourteen acres and a half. The external works were very irregular, but very strong, consisting of a deep ditch and high ramparts. The internal defences consisted of a citadel, which, from its elevated position, completely commanded the external works, and was capable of annoying the enemy beyond them; this was defended by a covered way and a fosse of about forty feet deep, surmounted by a rampart. This castle, called Basing House, was besieged for two years, and oftentimes nearly reduced to extremity, and as often relieved by the most extraordinary courage and conduct; it was ultimately taken by storm by Oliver Cromwell, in October, 1645. Here Dr. Thomas Johnson received his death-wound; he was the author of the first local catalogue of plants published in England, and of an improved edition of "Gerrard's Herbal;" and here the incidents occurred of which Sir Walter Scott has made so much use in his novel of "Woodstock." The following is the correct version of that event; "In the castle was Robinson the player, then an officer in the King's service; upon the Parliamentarians having got possession of the place, he offered his sword to, and requested quarter of General Harrison, who immediately shot him through the head, exclaiming, 'Cursed be he that doeth the work of the Lord negligently.'" After taking the house, Oliver Cromwell burned it to the ground. Large pieces of the walls still remain, also the north gateway and many other portions of the works; the whole forming an interesting object from the railway. The Basingstoke canal passes through the north side of the works. Basing is a chapelry in the parish and hundred of Basingstoke; the living is a Curacy not in charge, annexed to the Vicarage of Basingstoke; the Pop. 1103; An. As. Val. £5652.

The Old Basing Embankment is the first chalk work at which we arrive; it is three quarters of a mile long, and fifty feet high. We have on our left the interesting mound above described, and as the eye wanders along the peaceful canal winding its sluggish way, between those walls whose echoes were so often awoke by the screams of the wounded, and the groans of the dying, and whose quiet was so often invaded by the spirit-stirring and busy strife of battle; can we but regard with affection that wondrous political constitution which has so long averted from our hearths the miseries of war, and turned our energies to the cultivation of the arts of piece, and the prosecution of such works as canals and railways, which must add to (by increasing the means of obtaining) the happiness of man. The best situation to view the ruin is from the viaduct of four arches, which carries the railway over the Basing Mill river and road. The canal proceeds upon our left and parallel with it flows the river. Looking across both, and very near to them, are the plantations of Hackwood Park; the house, Hackwood Hall, cannot be seen, as it lies in a bottom, surrounded by trees; the entrance to the park is upon the high road to London.

This mansion is of very considerable dimensions, and situated as above stated; the grounds comprise upwards of 2,800 acres, characterised by bold inequalities of hill and dale, diversified with wood; the plantations are very extensive, and are in many places composed of the finest forest trees, which there grow in the most perfect luxuriance. The house was formerly a hawking lodge and banquet-room; it contains several portraits of the Paulet family; among the rest, the first Marquis of Winchester, by Holbein, and LAVINIA FENTON, the original *Polly* in the Beggar's Opera, who married the third Duke of Bolton, whom she survived; she died in 1760. The estate came into the possession of Lord Bolton by a marriage with the heiress of the late Duke of Bolton. A little further, upon the acclivity of the hill, is an object not so interesting to behold, but perhaps more necessary—the Union Workhouse; situated upon an open down it stands a prominent object in the landscape; its naked, cold-looking walls seeming to tell of breaking hearts and disappointing hopes; and of aged sorrow and of young care, each unsoothed by its natural associate: of the separation of them "whom God has joined together:" this *may* be an evil within its walls,—but, while we are thus moralising, a troop of young creatures—of happy faces and of healthful bodies—clean and well clothed, are advancing along the road under the superintendence of the matron of the workhouse and several assistants; here are beings rescued from ignorance and want—vice and misery! This world is a strange admixture of good and evil, and the bitter, we imagine, must be received with the sweet.

Basingstoke is seen in advance, upon the left, just before we enter a large chalk excavation, which we are now rapidly approaching; the cupola of its market-place appearing at this distance as the canopy of some classic temple. The view at this moment is worth notice, but is

quickly hid from us by the perpendicular chalk walls of the Basingstoke excavation; its extreme depth is about forty feet, consequently the country on each side is wholly hidden; it is rather more than a mile long, and yielded 245,000 cubic yards of chalk, among which was a considerable quantity of flint; having passed over, we arrive at Basingstoke, forty-six miles from London by railway. Upon the rising ground to the right is Basing Mill, near which Oliver Cromwell established his head-quarters during the siege of Basing House; upon the hill through which we have just passed, he is said to have erected his batteries. From this spot Basingstoke presents a most singular appearance, with its thickly-clustered houses rising up the hill from the valley —its modern market-house and classic cupola, and its ancient church, all of which are well seen from hence. A little farther on is a beautiful ruin; it is most advantageously seen from the railway—the Holy Ghost Chapel; it lies to the right of a viaduct of four arches, which bears the railway over the road from Basingstoke to Newbury; the remains consist of a tower of an hexangular form, of beautiful design and workmanship, and the south wall. The windows of the ruin are, of course, void of glazing; but are exquisite specimens of the architecture of the age, when art received so much encouragement from the erection of ecclesiastical edifices. These remains are the more curious, as this chapel is supposed to be among the first, if not the first, in the erection of which bricks were used in England: the bricks are faced with stone of about six inches in thickness. The pedestals upon which the niches rise, still remain, as does the canopy above them; these are richly ornamented. As no appearance of images have of late been met with, they were doubtless destroyed at the time of the civil war, when the chapel was desecrated by Cromwell's troops, and the lead in various parts of the building was removed to make bullets, to use against the garrison at Old Basing. This chapel appears to have been originally built by Lord Sands (in the time of Henry the Eighth), partially upon the ruins or walls of an ancient Saxon edifice: whether this was a Christian or a Pagan temple appears uncertain, unless we admit, as evidence of the latter idea, the fact that a Saxon idol was found while digging the basin of the Basingstoke Canal, near the town; if we admit this to be decisive, the wall upon which the present ruin partially stands, must have been built before Anno Domini, 596, the year in which Christianity was introduced into Britain, and consequently must be 1243 years old. After building the church, Lord Sands endowed it with land for the maintenance of a priest, whose duty it was to say mass and to instruot the boys of the town of Basingstoke, and the funds derived from a part of those lands contribute to the support of the present Free Grammar School, in which so many eminent men have received a portion of their education. We imagine that the inspection of these ruins will be interesting to everybody; they are, however, placed in a situation which commands so interesting and so lovely a prospect, that the mere admirer of the picturesque will feel the labour of arriving at the summit of the hill most amply rewarded, and we venture to predict, that thousands will visit the ruins of Basiug Chapel—the mounds of Basing House—and the neglected walls of Silchester, who but for the railway would, probably, never have heard of their existence."

METEOROLOGY.

ÆROLITHS.

Notice of a mass of Iron which fell in the Mogul Territories A.H. 1030. *or* A.D. 1620. *Translated from the original manuscript by Colonel William Kirkpatrick.*

Early on the 30th of Furverdeen of the present year, and in the eastern quarter of the heaven, there arose in one of the villages of the Purgunnab of Jalindher, such a great and tremendous noise, as had nearly, by its dreadful nature, deprived the inhabitants of the place of their senses. During this noise, a luminous body was observed to fall from above on the earth, suggesting to the beholders the idea that the firmament was raining fire. In a short time the noise subsided, and the inhabitants having recovered from their alarm, a courier was dispatched by them to Mahomed Syeed, the aumil of the aforesaid Purgannah, to advertise him of this event. The aumil, instantly mounting his horse, proceeded to the spot where the luminous body had fallen. Here he perceived the earth to the extent of ten or twelve juz* in length and breadth, to be burnt to such a degree, that not the least trace of verdure or a blade of glass remained; nor had the heat which had been communicated to it yet entirely subsided.

Mahomed Syeed hereupon directed the

* A juz is rather less than a yard.

aforesaid space of ground to be dug up; when the deeper it was dug, the greater was the heat found to be; at length a lump of iron made its appearance, the heat of which was so violent, that one might have supposed it to have been a furnace. After some time it became cold, when the aumil conveyed it to his own habitation, from whence he afterwards dispatched it, in a sealed bag, to court.

Here I had this substance weighed in my presence; its weight was 160 tolahs.* I committed it to a skilful artisan, with orders to make of it a sabre, a knife, and a dagger. The workman soon reported that the substance was not malleable, but shivered to pieces under the hammer.

Upon this I ordered it to be mixed with other iron. Conformably to my orders, three parts of the iron of lightning* were mixed with one part of common iron; and from the mixture were made two sabres, one knife, and one dagger.

By the addition of the common iron, the new substance acquired a fine temper; the blade fabricated from it proving as elastic as the most genuine blade of Ulmanny and of the south, and bending like them, without leaving any mark of the bend. I had them tried in my presence, and found them cut excellently, as well, indeed, as the best genuine sabres. One of these sabres I named katar, or the cutter; and the other, burk-serisht, or the lightning-natured.

A poet composed and presented to me on this occasion the following tetrastich:—

This earth has attained order and regularity through the emperor Jehangire;
In his time fell raw iron from lightning;
That iron was, by his word-subduing authority,
Converted into a dagger, a knife, and two sabres.

The preceding account was extracted verbatim from the memoirs of Jehangire, emperor of the Moguls, written in Persian by himself in the year of the Hegira, 1020, and communicated to the Royal Society by Mr. Greville, from which extract the above is a translation by Col. W. Kirkpatrick.

Query: Could some of the ærolites of the present day be successfully used in the tempering of iron or forming steel?

J. B.

Paper-making in the East.—At the last meeting of the Royal Asiatic Society, there was exhibited a sheet of paper measuring 60 feet by 25, made at Kumaire, in Hindostanee.

* A tolah is about 180 grains troy weight.
* Thunderbolt.

ESTABLISHMENT OF NEW MECHANICS' INSTITUTIONS.

A Lyceum for the borough of Finsbury, under the patronage of Lord Brougham, is intended to be formed for the moral and intellectual improvement of the labouring classes, to realize for them the advantages that are abundantly experienced by the rich, the high, and the middle classes, in their Royal Institution, Royal Society, Literary and Philosophical Societies, Athenæums, Literary Institutions, and Mechanics' Institutions. From the above-named institutions, working men are, to a great extent, excluded; not by any specific law, but that most powerful of all laws — the law of the pocket. The Mechanics' Institution of London has very few members of the working class of mechanics. The price of membership is too high.

It is therefore contemplated to establish Lyceums in various parts of the metropolis, and thus afford to the working classes the educational advantages of a Mechanics' Institution, with reading and coffee-rooms, and other features of a recreative character. So soon as adequate funds shall be realised, to open for this purpose Providence-hall, 22, Finsbury square, will, it is hoped, exhibit to the public, more especially to the wealthy and benevolent, the advantages to be derived from such institutions. The Lyceum will include within its arrangements,—1. A library and reading-room; 2. A coffee-room; 3. Occasional meetings for musical and other rational recreations; 4. Classes; 5. Lectures. The method suggested to bring such advantages within the reach of the working classes, is to fix upon a small sum of admission, which will be within the means of working men. It is proposed that the subscription should be 8s. a year, or 2s. a quarter, or 2d. a week, payable in advance.

The experiment of such an institution has already been made, on a small scale, in Bermondsey, where the prospect of success is most encouraging, and where there is every reason to anticipate, ere long, the most beneficial results in the moral and intellectual improvement of those for whose benefit it was designed.—*Patriot.*

Pursuit of Knowledge.—By looking into physical causes, our minds are opened and enlarged; and in this pursuit, whether we take or whether we lose the game, the chase is certainly of service.—*Burke.*

THE CHEMIST.

CONSIDERATIONS ON CHEMICAL FORCES.

(*Concluded from page* 268.)

The solubility of oils in alcohol gives precisely the same result as that of a solid body; the solubility is very feeble at a low temperature, and increases progressively with an increase of temperature. Thus a body, whether it remains constantly liquid, or whether it be first solid, and afterwards becomes liquid, presents in each of these circumstances the same phenomena of solubility. Even gaseous substances, such as chlorine, do not appear to alter the regular progression of their solubility at the moment of their passing from one state to another.

If the cohesion of a salt had great influence upon its solution, the solvent would never become completely saturated by simple contact with it, and the solution, separated from the salt, might be cooled to a certain number of degrees without abandoning any salt. Now this is not the case; the solution abandons a portion of its salt the instant it suffers the least diminution of temperature. It may then be assumed, that, in general, cohesion takes no part in producing solution. The solution of a body, like the elasticity of vapours, varies with the temperature; it is also affected by the reciprocal affinity of the solvent, and the body dissolved; but the effects of affinity not being variable with the temperature, while those of solution depend essentially upon it, it cannot be disputed, that in solution, as in vaporization, the produce is essentially limited at each degree of temperature, by the number of molecules which can exist in a given portion of the solvent; they separate from it for the same reason that elastic molecules are precipitated by lowering the temperature, and probably also, like the latter, by compression and reduction of the volume of the solvent. Thus when the temperature is lowered in a solvent saturated with a body, the molecules in excess with the new temperature are precipitated, not in virtue of cohesion, which is supposed to solicit them to separate and aggregate themselves, but because they can no longer be maintained in the solvent, as it happens to a vapour in a saturated space when the temperature is lowered. It is of little importance whether the molecules which are ejected by the solvent, assume a solid, liquid, or even an elastic form. Solution, then, is essentially connected with vaporization in this respect, that they are both dependent upon temperature, and obey its variations. They may, therefore, be considered as offering, if not a complete identity, at least a great analogy of effects. But although analogies may exist between solution and vaporization, it may be asked, why the solubility of some salts, such as the sulphate, the seleniate of soda, suddenly presents a point of retrograde, and a decreasing march, while the elastic force of vapours follows a regular ascending law? In the first place, it must be remarked, that the difficulty remains the same, whether analogies exist or not between solution and vaporization, and it cannot, therefore, constitute a serious objection. Secondly, the point of retrograde action in the solution may be easily explained by the consideration, that at this point it is no longer the same body which continues to dissolve. Thus, from about 0° to 8, the space of temperature during which chlorine is in the hydrate state, the solubility is ascendent; but at the latter term, the hydrate is decomposed, and immediately the solubility follows a decreasing progression up to 100°, where it almost ceases. It is evidently the hydrate which is dissolved under 8°, and above that point, the chlorine alone.

In comparing solution with combination, a remarkable difference may be assigned, namely, that the solution varies at each instant with the temperature, while combination is not sensibly affected by those variations. "If my observations are exact," says M. Gay Lussac, "they must weaken the influence which Berthollet attributed to cohesion in all chemical phenomena; but I am too sensible of the weight of that illustrious authority, not to consider even my own arguments with suspicion." Berthollet has often repeated, that when one body precipitates another, it is not always an indication of superior affinity; the cohesion of the precipitated body determines the decomposition. On the contrary, according to the principles which have just been established, cohesion takes but a secondary part in the precipitation, as in solution. Precipitation always proves the existence of a greater affinity; cohesion only renders its effects sensible.

With respect to decompositions by double affinity, the explanations of Berthollet and M. Gay Lussac are equally diverging. If a solution of sulphate of soda be mixed with a solution of nitrate of lime, sulphate of lime is precipitated, and nitrate of soda remains in solution. According to Berthollet, there is double decomposition, because the sulphate of lime is the most

cohesive of the four salts which may be conceived, after the mixture, in the solution previously to the precipitation. Berthollet conceives, that although the sulphate of lime does not yet exist, the cohesion which it is about to assume, determines its formation, as well as its separation.

This explanation never appeared very satisfactory. So long as the sulphate of lime is supposed not to exist in solution, the cohesion which it is afterwards to possess, cannot be invoked to explain its formation and precipitation; neither can we, for the same reasons, invoke its insolubility; that cannot determine the exchange as a first cause, but only render it sensible and effective after it has been operated, by determining the operation of its products. What then is the cause which really presides in the exchanges which take place in double decompositions by double affinity? If we direct our attention to the precipitates which result from the action of double affinities, it will be perceived that the most stable precipitates are not necessarily those which are formed from acids and the most powerful bases. Thus the sulphate of potass, although formed of elements endowed with a powerful affinity, may be transformed by mixture with the acetate of lime into sulphate of lime, whose base has much less affinity than potass for sulphuric acid. In the mixture of sulphate of lime with the carbonate of ammonia, the lime is precipitated with carbonic acid in less stable combination than that which it previously formed. It would be easy to cite a multitude of similar examples.

We cannot, therefore, truly say, that after the mixture of two saline solutions, the strongest acid always unites with the strongest base; it would appear, on the contrary, that the salts in a state of neutralization, may effect an exchange of acids and bases, independently of their reciprocal affinities. The exchange between the acids and bases of two salts may take place, according to Berthollet, in several ways. Besides this insolubility, which generally determines a difference of fusibility, density, and volatility, may also produce it. Now in the case, for example, of a difference of volatility, the reciprocal affinity of the molecules can no longer be admitted as in the case of a solid, or even a liquid, since the molecules of a salt which separate, are in a state of repulsion, and it might also be demonstrated, as it is always the most volatile salt which is formed. Thus the exchange taking place according to the received opinion, in very different circumstances of solubility, density, fusibility, and volatility, one of them cannot be the real cause of the exchange to the exclusion of the others; and, consequently, the cause should be sought elsewhere, independent of these circumstances.

Since the exchange is not determined by the reciprocal affinity of the acids and bases, nor by the secondary causes we have enumerated, and, nevertheless, separations are operated by these latter causes, it must necessarily be admitted that the exchange precedes them; and at the moment of the mixture, before any separation takes place, there is a confusion of acids and bases; that is to say, the acids combine indifferently with the bases, and reciprocally: the order of the combination is of little import, provided the acidity and alkalinity are satisfied; and they evidently are so, whatever perturbations may take place between the acids and the bases.

This principle of indifference of permutation being established, the decompositions produced by double affinity are easily explained. At the moment of the mixture of the two neuter salts, two new ones are formed, bearing some kind of analogy to the two former; and, now, according as one of these properties, insolubility, density, fusibility, volatility, &c., is more pronounced in the new salts than in the given ones, the equilibrium will be troubled, and the separation of one or more salts will take place.

"It is, however, essential to remark," says M. Gay Lussac, "that although we admit a confusion at the moment of mixture of two or more saline solutions, it may not always rigorously take place. It is known that the molecules of a compound oppose a kind of inertia to change, and that time or agitation is often necessary to operate it.

Many saline solutions, and particularly that of the sulphate of soda, will remain over saturated at temperatures considerably below that at which they should deposit their salt. A solution of sulphate of magnesia, mixed with a solution of oxalate of ammonia, does not give a precipitate of oxalate of magnesia till a long time after the mixture, if it be left at rest; but it is produced in a few seconds by means of rapid agitation. Besides the circumstance of the inertia of the molecules, which is opposed to change, a state of indifference between the acids and bases may be admitted; that is, a state of instability, such that the least circumstance, even a very feeble cohesion, may disturb

the equilibrium, and determine the exchange.

Admitting that the confusion of molecules has commenced, it may still be conceived, that the separation of the newly-formed salts is not effected instantaneously, for the same reason that water will remain liquid several degrees below zero. It is therefore possible to conceive the reciprocal action of molecules uniting in a solid or fluid mass. M. Gay Lussac considers that it participates but in a small degree in the production of chemlcal phenomena.

It is easy to demonstrate the exchange between the elements of two salts, although it be not accompanied by the production of a precipitate. Let a solution of acetate of soda be mixed with a solution of sulphate of protoxide of iron, and pass a current of sulphuretted hydrogen into the mixture; a precipitate of sulphate of iron will immediately be formed; which indicates that acetate of iron was previously formed. In this case it may, indeed be objected, that the exchange takes place because the stronger acid (sulphuric) unites to the strongest base, which is the soda; but this objection appears unfounded, if we recollect that the reciprocal affinity of acids and bases appears entirely foreign to the formation of precipitates obtained by the concourse of double affinities.

The principle of chemical *equipollence*, or permutation, which we have admitted with regard to saline substances, appears to extend to all analogous compounds, that is to say, to all those in which the sum of the neutralizations will be after the mixture as before; as, for example, water and chlorine.

Here a very remarkable effect is observed. It appears, that in the combination of two acids with two bases, there is expended a certain quantity of action, chemical or electric, which remainsco nstant in the exchange.

We shall return to this important investigation when M. Gay Lussac has published his promised papers.

Illuminated Clock Dials.—On Tuesday evening the celebrated Horse Guard's clock was illuminated for the first time. The illumination was effected by means of the "Bude Light," which is placed externally, and falls on the dial. The light itself is screened from view. It is much superior both in beauty and cleanness to the ordinary transparent dials. When illuminated clocks were first introduced in Paris, it was supposed by many persons that the dials were transparent, their appearance resembling, in a remarkable manner, the effect of a light seen from the opposite side of a semi-transparent substance. They were, however, and are still, lighted from the outside, in the manner of the Horse Guard's clock; and as this method is far superior in effect, and more economical in construction, it is not improbable, strange as it may appear, that the transparent dials of London were introduced through a mistake, occasioned by a misapprehension, and wrong description of the principle upon which the French clocks were illuminated.

To write letters, secretly, from one friend to another that cannot be discovered.—Double, in the middle, a sheet of white paper, then cut holes through both the half sheets, like the panes of a glass window, or what fashion you please; then, with a pin, prick two little holes at each end, and cut your paper in two halves; give one-half to your friend to whom you design to write, the other half keep yourself. Now when you write, lay your cut paper on half a sheet of writing paper, and stick two pins through the two holes that it stir not; write, then, your mind to your friend through these holes; then take off the paper with the holes, and write any nonsense to fill up the vacancy. When your friend receives your letter, let him lay his cut paper on it, putting the pins into the holes, and then the nonsense is covered, and he reads your mind.—*From an ancient writing.*

Indelible Ink.—We have been shown a specimen of indelible ink, prepared by Mr. Sparkhall; on the same sheet of paper were specimens of different kinds of ink, purporting to be indelible, but a portion of all of them was effaced by chemical tests, with the exception of Mr. Sparkhall's, which was not altered in any degree by any of the re-agents applied. Five pounds is offered to any one who can discover a test to remove this ink. The inks which had succumbed to the re-agents, were Stephens's, Phelps's, and Watts's. It may be seen at No. 142, Cheapside.

Fiery Fountain.—If twenty grains of phosphorus cut very small, and mixed with forty grains of powder of zinc, be put in four drachms of water, and two drachms of concentrated sulphuric acid be added thereto, bubbles of inflamed phosphorated hydrogen gas will quickly cover the whole surface of the fluid in succession, forming a real fountain of fire. HEJE.

GLEANINGS.

When the air-balloon was first discovered, some one flippantly asked Dr. Franklin what was the use of it? The Doctor answered this question by asking another: "What is the use of a new-born infant? It may become a man."

Charles the Fifth, emperor of Germany, when he abdicated a throne, and retired to the monastery of St. Juste, amused himself with the mechanical arts, and particularly with that of a watchmaker. He one day exclaimed, "What an egregious fool must I have been to have squandered so much blood and treasure in an absurd attempt to make all men think alike, when I cannot make even a few watches keep time together."

Peculiar Method of dividing Time.—The inhabitants of Feroe Island have one method of dividing time peculiar to themselves; they reckon the day and night by eight *okters* of three hours each; the *okters*, again, are reduced into halves, and they are named according to the point of the compass, where the sun is at the time: for example, east-north-east is half-past four in the morning; east is six; south-east, half-past seven.—*Laudt.*

Lightning Conductors.—It is fancied by many, that it is sufficient to put an iron rod, with one end in the ground and the other a few feet higher than the roof, to protect a building from lightning. It should be impressed on the public, that conductors, unless perfectly insulated, are calculated to produce the disaster they are intended to prevent. The best mode of insulating them, is for them to pass through glass rings, and in no part to be in contact with anything but glass. The lightning conductors placed on the Royal Exchange, Paris, are a perfect model in this respect.

An Ingenious Plan for Raising Coals in the coal-pits in the parish of Dalmellington, Ayrshire, has been for some time in use. The pit is dug in the side of a hill, and has a small stream turned to its mouth. It is divided into two square compartments, to which water-tight boxes, partly open above, are fitted, and upon which the coal creels are placed. The water escapes from the box by a ealve in the bottom of it. This valve is opened by an iron peg fitted to it, striking against a stone at the bottom of the pit, and the water runs off into a level or tunnel to the stream at the foot of the hill. The mot.on is regulated by means of a a lever pressed upon the wheel over which the rope passes. The apparatus is the simplest and safest possible, is managed with the greatest ease, and has worked successfully.—*Statistical Account of Scotland.*

TO CHANGE THE COLOUR OF FLOWERS.

Get some violets, and place them in a glass jar inverted in a dish of water. Place a metallic vessel, or a common piece of tile, in the jar, and on it put a little sulphur, which is to be ignited. If the violets are exposed to the gas, which is thus formed for a short time, their colour will be destroyed, and they will be *blanched.* The same effect may be produced on a variety of other flowers.

Hold some of the violets, after the last experiment, in the vapour (muriatic gas), which arises on pouring a little dilute sulphuric acid on common salt; they will then assume a *red colour.*

Put a number of flowers, of any colour, and a few blades of grass, or some green leaves, into a bottle containing some chlorine gas, and their colour will be immediately destroyed. This is very prettily illustrated, by placing in the bottle a sprig or two of parsley, which, by the action of the chlorine, is rendered quite white.

Chloride of lime, dissolved in water, with a little of any of the acids added to it, may be employed for this purpose instead of chlorine gas; or even the dry chloride of lime may be used for the same purpose.—*Dalton's Book of Experiments.*

Important Discovery in Type-founding —A type-founder of Clermont, named Colson, has obtained a patent for a new material for printing type, which is harder, capable of more resistance, and yet less expensive, than the ordinary composition of lead and antimony. It is well known that types cast from the latter soon become worn, especially since the introduction of machine printing. Colson asserts that the material is so hard that the types themselves will serve for punches in striking matrices, and that it will last ten years without being more wore than the usual composition is in one year.—*Foreign Monthly Review.*

Animal Affection.—We heard a little anecdote so pretty and so much in your taste, that I would not, upon any account, omit relating it to you:—About ten days ago one of the farmkeeper's wives was going homewards through the wood, when she saw a roebuck running towards her with great speed. Thinking that it was going to attack her with its horns, she was considerably alarmed; but at the distance of a few paces, the animal stopped and disappeared among the bushes. The woman recovered herself, and was proceeding on her way, when the roebuck appeared again, ran towards her as before, and again retreated, without doing her any harm.

On this being done a third time, the woman was induced to follow it, till it led her to the side of a deep ditch, in which she discovered a young roebuck unable to extricate itself, and on the point of being smothered in the water. The woman immediately endeavoured to rescue it, during which the other roebuck stood by quietly, and as soon as her exertions were successful, the two animals galloped away together.—*Lewis's Life.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, July 24, R. Addams, Esq., on Chemistry. Friday, July 26, J. Tennant, Esq., on Gems and Ornamental Stones and Jewellery; their Composition, Locality, Mode of Working, and means of distinguishing them from Composition.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, July 23, Dr. John Walker, on the Structure and Functions of the Eye.

QUERIES.

A receipt for ginger beer, soda water, and effervescing lemonade; a small quantity, say a pint. G. F. F. G.

Whether "Architector's" papers on building are to be continued in "The Mechanic," as I am desirous of perusing his opinions on the other remaining branches of the art? H. C. MILLNER.

St. John's Wood.

1. What must sulphur be mixed with, to make it thinner than when melted by itself, or whether it can be done? 2. Likewise, a complete process for making chlorate of potass. "J. B." said in one of your numbers, he would, if required, give the process, as I know nothing about its manufacturing apparatus? 3. How to stain paper a pink colour? 4. How to make cases for sky-rockets, with a description of the apparatus for moulding them? 5. What is the construction of a planeing machine for wood?

Manchester. PUBLICO.

The method of making the transparent varnish for the glasses of the magic lantern, as the varnish which I have tried partly obscures the objects and destroys the effects?

A YOUNG EXPERIMENTALIST.

[Try gum mastic dissolved in spirits of wine.]

Sir,—I beg to inquire of "J. Langstaffe," through the medium of your valuable journal, whether he has a velocipede capable of being worked, the description of which he has given in No. 20, N.S.; if so, where it can be seen, and whether he has made an experimental trip; and if he has not one made, what he considers would be the probable cost of its manufacture. His answer to this will oblige. E. J. S.

ANSWERS TO QUERIES.

To make Powder Gold.—"P. T." (queries No. 1, 4, & 5). 1. Gold may be procured in powder by grinding leaf gold in honey on a marble slab with a muller, then dissolving the paste formed in water, the gold will fall to the bottom of the vessel, which must be washed and dried.

4. Retorts of every description may be purchased at Dymond's, 146, Holborn-hill.

5. *To distinguish Palladium from Platinum.*—Palladium may be distinguished from platinum in this way:—when a drop of tincture of iodine is let fall on the surface of this metal and dissipated by the heat of a lamp, a black spot remains, which does not happen with platinum.

To remove Dark Spots from Lacquered Work.—"W. J." Dark spots, &c., are removed from lacquered work, first by boiling the article in water with soda dissolved in it, then putting them in what the workmen call pickle, which is aqua fortis (nitric acid) somewhat diluted for one, two, or three minutes, according to the strength; they are then taken out and dried in saw-dust. If the acid has sufficiently acted upon the metal, they then have a dull appearance. The parts intended to be bright are to be rubbed with a polished steel instrument, called a burnisher, varying in form according the work they have to perform. These must be kept wet with beer until in use; they are then warmed and lacquered with one and the same lacquer all over; not as "W. J." supposes, one lacquer to produce the pale part, and another the bright. Sometimes a little salt is added to the pickle. A little muriatic acid, I think, would make it *bite* sooner, as the workmen say.

JUVENILE ENTERTAINER.

To take a Cast from a Person's Face.—"F. Jones." While reading a little work a few days since, I met with the following, which may answer his purpose:—"The person whose likeness is required in plaster must lie on his back, and the hair must be tied back, so that none of it covers the face. Into each nostril convey a conical piece of stiff paper, open at both ends, to allow of breathing. The face is then lightly oiled over in every part with salad-oil, to prevent the plaster from sticking to the skin. Procure some fresh burnt plaster, and mix it with water to a proper consistence for pouring. Then pour it by spoonfuls quickly all over the face (taking care the eyes are shut), till it is entirely covered to the thickness of a quarter of an inch. This substance will grow sensibly hot, and in a few minutes will be hard. This being taken off will form a mould, in which a head of clay may be moulded, and therein the eyes may be opened, and such other additions and corrections made as are necessary. Then this second face being anointed with oil, a second mould of plaster must be made upon it, consisting of two parts joined lengthwise along the ridge of the nose; and in this a cast in plaster may be taken, which will be exactly like the original."

Extraction of Grease Spots.—"R. E. W." Place some blotting-paper on each side of the part infected, press a heated iron on it several times (having previously covered the part with ether), and the grease will be saturated in the blotting-paper.

To prepare Skeletons of Small Animals.—"P. T." A very excellent receipt is given for

the above purpose in No. 73 (Old Series) of the "Mechanic." PROPORTIO.

To make and destroy Colours.—Drop as much sulphate of copper as forms a colourless solution; add a little ammonia, which is equally colourless, and the mixture becomes of an intense blue colour. Add again a little sulphuric acid, and the colour disappears, which is again restored by a little solution of caustic ammonia. P. T.

To Melt Black Antimony.—The best way is in a covered crucible, in a charcoal fire, and flux it with a little sal nixon, or cream of tartar.

To make Fluoric Acid.—"F. Jones." Fluoric acid (so called because it is obtained from fluor spar, a well-known mineral production in some of the mining districts in England, and long employed as a flux for metallic ores. Its remarkable property of corroding glass, when decomposed by sulphuric acid, was observed soon after the middle of the 17th century; and after various attempts by other chemists, the composition of fluor spar was ascertained by the experiments of Schede, and found to be lime and a peculiar acid, which he distinguished by the name of fluoric acid), is prepared in the following manner:—The fluor, or Derbyshire spar, is reduced to fine powder, and is introduced into a retort of silver or lead, with twice its weight of concentrated sulphuric acid, and the retort being connected with a receiver of the same metal, cooled with a mixture of snow and salt, heat is applied to the retort, and the acid is driven off and deposited in the receiver in the liquid form. This liquid should be kept at a temperature of 60°, and should it perchance be left in the open air, it gives out copious suffocating fumes, and is soon dissipated.

Sulphate of Soda.—"F. Jones." This salt is a compound of sulphuric acid and soda, which is well known by the name of Glauber salt. It may be prepared by the direct combination of the acid and alkali; but it is usually obtained by the decomposition of sea salt, by means of sulphuric acid in the manufacture of sal ammoniac. The solution being filtered, purified, and slowly evaporated, transparent crystals, in the form of six-sided prisms, terminated by two-sided summits, are obtained. This salt has a cool, bitter, and nauseous taste, effloresces in dry air, is very soluble in cold water, and requires for its solution only about three-fifths of its weight of boiling water.

To render Cloth Waterproof.—"A Constant Reader." Cloth is rendered water-proof, by being thoroughly soaked in a strong solution of common salt and water. E. J. S.

TO CORRESPONDENTS.

T. C. D. (Dublin). *Genuine bell metal is made of copper and tin. We will make inquiries on the subject of his other query.*

M. T. N. *His pencil drawing is not sufficiently distinct to explain his intention accurately.*

F. Flaxman *and* D. G. R. *shall be attended to.*

S. L. *will find the water colours and other drawing materials at Mr. Ackerman's, in the Strand.*

C. G. Lidy *may obtain the articles and information he requires of any respectable optician. Wood is preferable to iron for the wheel of a velocipede, as it may be made lighter, little strength being required.*

A Constant Subscriber.—*A solution of pearl ash (or any alkali) saponified by the addition of grease, would answer his purpose; but why does he object to using soap ready prepared?*

H. S Pratt (Camden Town). *Our correspondent wishes to be informed how to dye hair black, or brown; and he complains that his query has not been attended to. If he will take the trouble to refer to a few of our last numbers, he will find several different receipts, and in the interim he may try a solution of nitrate of silver (lunar caustic), but it would be prudent first to try its effect upon a portion of hair of no value.*

Explorator.—*The focal length of a lens may be found by holding it between a white surface and a candle placed at a distance; when the image of the candle appears distinct, the distance of the glass from the surface which receives the image, is the length of the focus. To silver a piece of glass, take a piece of tin-foil of the required dimensions, and cover it with mercury, spreading it by means of a hare's foot, or piece of rag; then lay a piece of clean writing paper on the silvered side of the tin, and place the glass over the paper; press down the paper, and then place a weight on the glass (it being of course laid on a flat surface), and in a few hours it may be removed, and will be found as bright as an ordinary looking-glass. Glass covered with black varnish would not answer for the reflector of a camera obscura; a small quantity of light is reflected by a transparent surface, but the greater portion of the rays pass through, and in this case they are absorbed, or lost, on the black surface. We have before stated, that photogenic drawings cannot be obtained from the camera obscura by the process at present known. A recompense has been awarded to M. Daguerre (6000 francs, or 240l. per annum) by the French Chamber of Deputies, and it is probable that his process will shortly be made public. When it is so, we shall take care to give our readers the earliest information on the subject.*

F. Price *shall be attended to.*

H. E. J. E. *Anderson's steam drag is expected in London daily; it will most probably have arrived before the publication of this work. The articles he refers to shall appear as soon as possible.*

A Boiler Maker *is informed, that the subject of his communication appeared in the first volume of this Journal.*

The answers to several queries omitted in this number will appear next week.

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THE

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EARLY ENGLISH ARCHITECTURE

FIG. 1.

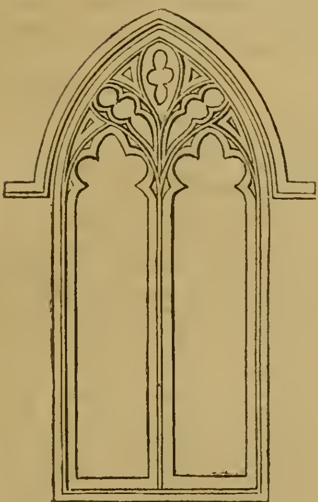
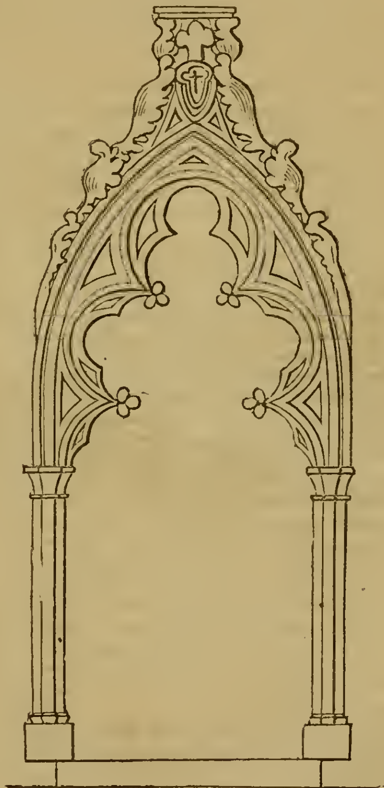


FIG. 2.



City Press, 1. Long Lane, Aldersgate Street: D. A. Doudney.

HISTORY OF ARCHITECTURE.

NO. V.

(See engraving, front page.)

Allusion might be made to the progress of architecture in the countries less renowned for specimens of this art, than those I have treated of, such as Persia, Assyria, India, and many others. Space, however, forbids. Suffice it to say, that the Persians Assyrians, Phœnicians, and Hindoos, built much after the manner of the Egyptians. The Jews, a simple. harmless, people, made little progress in the art. But I now wish to advance to the contemplation of the "history of architecture" in a country far more interesting to us, than any or all of the preceding. I refer, of course, to our own country—England.

After the invasion of England by the Romans, that people erected many buildings of more and less architectural merit; and these it was that primarily directed the attention of the Saxons then inhabiting it, to the study and practice of this beautiful art. Like the Romans, when *they* first took up the art, the Saxons were a warlike uncivilized nation, continually engaged in hostilities of one sort or another; consequently architecture for a long period made no rapid progress; in fact, it remained almost at a stand-still until the latter end of the twelfth century, when the people having become more settled, peaceful, and refined, architecture, as if to make up for the previous delay, advanced at an astonishingly rapid pace.

We will, however, pass over the first attempts and more immediate improvements upon them, and proceed at once to consider the three grand divisions of Gothic architecture. They were, 1st. *The early English style,* which commenced about the year of our Lord 1190; 2ndly. *The decorated English style,* first practised about the year 1300, 3rdly. *The florid,* called also the *perpendicular style,* which commenced about the year of our Lord 1380. We will now more fully notice each of these styles.

The early English Style.—The principal features of this style are solidity and simplicity, and great freedom from ornament. The windows are long and slender, generally with very pointed arches, and mouldings of a bold character. The doors are considerably recessed, and have very simple, though numerous mouldings, to a highly pointed arch. The arches of this style are distinguished for the boldness of their mouldings. Beverly minster is an excellent example of the early English style*. Though ornament was, as I before observed, rarely introduced in this style in the early periods of its use, in time it was much more so, and gradually increased, almost imperceptibly, until this style gave way at length to the *decorated.* Fig. 1 represents a window in this style, of a late period, and enriched with tracery and numerous mouldings.

The Decorated English Style.—This is much more ornamental and delicate than the preceding. Gothic architecture is peculiarly adapted to religious edifices, and has been almost exclusively used for them; but this style (the *decorated*) is esteemed as the most so. The windows are larger, and much wider in proportion than those of the first style, and the arch is in general about the acuteness of an equilateral triangle. The doors are not so easily distinguishable from those of the *early English style* as the windows. The mouldings are less numerous, but, of course, much more ornamental. York cathedral is an excellent specimen of the *decorated English style.* Fig. 2 is a sketch of the doorway of Lincoln cathedral, which is in this style.

Proportio.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 277.)

The Watford station, $17\frac{3}{4}$ miles from London, is nearly two miles beyond the eastern end of the town, through which the line passes. Conveyances on the omnibus plan are established from the station to the western end of the town, a distance of about a mile.

The town of Watford in Herts, is fifteen miles from London by the old road; it is situated on the side and summit of a hill, at the foot of which is a bridge over the river Colne. It consists, principally, of one well-built street, which forms a portion of the high road, and is nearly a mile in length.

Previous to the conquest, Watford was included under the appellation of Caishoe, or Cashio, and given by King Offa to the Abbey of St. Alban. It afterwards passed successively into the possession of several noble families, and in 1760, the Duke of Bridgewater sold it to the Earl of Essex, in whose family it still remains. The

* This example is not entirely of the early English style; for instance, one of the pinnacles of the nave is of the second style, and I might mention other parts.

charter of the market, held on Tuesdays, was granted by Henry I.; and Edward IV. granted a charter which authorizes the holding of two fairs annually, on Whit Tuesday, and August 29th and 30th, for cattle, horns, and pedlary; a fair is also held on the 9th September, for hiring servants. Watford is surrounded by a beautiful woody country, adorned with magnificent mansions, and numerous villas. The church, dedicated to the Virgin Mary, is situated in the centre of the town. It is a spacious stone building, irregular in form, and disfigured by a coat of modern plaster; it consists of a nave, aisles, and chancel, with a massive square tower at the west end, about eighty-five feet high, surmounted by a small hexagonal spire, about twenty feet more. There are eight bells in the tower, and chimes to the clock. On the north side of the chancel is a large chapel, or mausoleum, formerly for the Morison family, and now belonging to the family of the Earl of Essex. This chapel, called the "Tomb House," contains numerous tombs, some of which are of the highest class of sculpture. At the south side of the church-yard is a free school, founded and endowed by Mrs. Elizabeth Fuller in 1704, for forty boys and twenty girls, who are partly clothed and instructed in the rudiments of useful education. The roads in the vicinity of Watford are good, and afford agreeable rides in every direction. The village of Bushy, about a mile from Watford, is situated near Bushy Heath, which extends towards Stanmore; this heath is the highest ground in the county of Herts, and exhibits an extensive view on all sides; Westminster Abbey, Hampton Court, Windsor Castle, and St. Alban's Abbey, are distinctly visible from it, and the Thames is seen winding through Middlesex and Surrey.

Bushy, though but a small village, can boast of considerable antiquity; many of its former possessors have been remarkably unfortunate. Geoffry de Mandeville, its first Norman possessor, was denied Christian burial, and suspended from a tree, for having incurred the Pope's displeasure; Edmond, of Woodstock, was beheaded, Thomas, Duke of Surrey, met the same fate; Thomas de Montacute, Earl of Salisbury, was killed at the siege of Orleans; Richard, Earl of Warwick, was killed at Barnet; George, Duke of Clarence, was drowned in a butt of wine; Richard III., the next possessor, was killed in Bosworth field. Had he known that his misdeeds and misfortunes had laid the foundation of one of the greatest productions of the Poet Laureat of the human race, the terrors of a guilty mind, and the bitterness of an untimely death, would have been assuaged and mitigated by the consoling reflection, that though his deeds had blotted a fair page in the British annals, that page would be illuminated by the never-fading light which follows every trace of Shakspeare's magic pen. Lady Margaret de la Pole, Countess of Suffolk, was beheaded at the age of seventy-two, by order of Henry VIII., in revenge for a *supposed* offence committed by her son! Titas Silas, the author of a pamphlet entitled "Killing no Murder," in which Cromwell was advised to commit suicide, also resided in this parish.

The church is very small, and, according to an inscription recently discovered, was built in the year 1006. In the church-yard are numerous wooden tombs, consisting of two uprights supporting a cross piece, on which some edifying *morceaux* are inscribed.

Seven miles from the Watford station, and twenty miles from London, on the Ver, a branch of the Colne, is the ancient town of St. Albans; it was a chief city, and a royal residence, before the Roman invasion; it was called by the Romans, *Verulamium*, or *Verulum*. The Italian usurpers added walls to the ancient British defence, which consisted of mounds of earth and ditches. The citizens of Verulamium, seduced by the favours and privileges, granted to them by the Romans, became so attached to the foreign intruders, as to bring upon themselves the vengeance of Queen Boadicea, who caused a great number of them to be slain; she was, however, afterwards defeated, and it is said that 86,000 Britons were put to death by the Roman governor of Britain. After this event, the inhabitants continued to enjoy their privileges, till the persecution under the emperor Dioclesian, in the year 304; when their citizen, St. Alban, was sacrificed to Bacchus, Venus, Silenus, Momus, and other fictitious disorderly characters, whom the *enlightened* Romans pretended to believe were deities.

When Verulamium afterwards fell into the hands of the Saxons, its name was altered to Werlameaster, or Watlingceaster. The ancient Roman wall may still be traced, and large fragments of masonry are standing at the present day. The area of the city was 5200 feet in length and 3000 in breadth. After various revolutions and wars, this great city fell to decay, and its ancient site is divided into fields; but some relics of the buildings and vestiges of the streets may still be discovered. The present town of St. Albans

is situated upon an eleveted spot near the old city. The Abbey, erected in honour of St. Alban by Offa, king of Mercia, in atonement for the murder of St. Ethelbert, king of the East Angles, appears to have been the nucleus round which the present town has arisen. Little now remains of this once magnificent monastery, except the Abbey church, which was rescued from impending destruction, by the laudable exertions of the corporation and citizens, who purchased it from Edward VI. for 400*l.* which was a great sum in those days. The entire length of the building is 539 feet; the height of the tower 144 feet. The whole structure was rebuilt soon after the Norman conquest, and a great portion of the materials appear to have been obtained from ancient Verulum. In the centre of the town there formerly stood one of the magnificent crosses erected by Edward I. in honour of his queen Eleanor, but it was taken down in 1703, and an open octagonal building erected on its site, which still retains the name of "Cross."

Since the construction of the London and Birmingham Railway, St. Albans has been much injured by the diminution of traffic on the road; the Romans, Saxons, and Normans, have passed away, and the same fate is impending over the race of innkeepers, post-masters, blacksmiths, and others, depending for subsistence on the traffic of the road; but the Ver flows placidly on, unshaken by the violence of revolutions, uninjured by the desolating hand of time. The palace of Offa, and the proud Abbey of St. Alban, have vanished with their tenants; but the waters rejoice in eternal youth, the sparkling waves return the sun's warm smile, and the undiminished stream still glides on to feed the insatiable abyss of the ocean.

It is a general custom with the citizens of London, to become sentimental when they arrive at the distance of twenty-one miles from town. Having paid this brief homage to a good old custom, the reader may consider that he has crossed the line of sentimentality, and return to Watford by an omnibus, which the lovers of old fashions will rejoice to find is not yet propelled by steam.

Abbots Langley, a village in the hundred of Cashio, is remarkable for having been the birth place of Adrian IV., the only Englishman who ever attained to the dignity of Pope. The church is partly in the Norman, and partly in the Gothic style of architecture.

Cashiobury Park, at Watford, is one of the numerous relics of antiquity with which this part of the country abounds. It is said to have been the residence of the kings of Mercia, till Offa gave it to the monastery of St. Albans. After the dissolution, it was granted by Henry VIII. to Richard Morison, Esq. It is now the residence of the Earl of Essex. The present mansion was erected in the time of Henry VIII.; the apartments are spacious, and elegantly decorated. In a cloister, the windows of which are beautifully decorated with stained glass, there is a very old painting, supposed to be the only *original* portrait in existence of Henry IV. The park is an extensive and beautiful domain, abounding with noble trees of various kinds. The river Colne, and the Grand Junction Canal, pass through the park, adjoining Cashiobury, is Grove Park, the seat of the Earl of Clarendon. The mansion is an irregular brick building, in a park through which the river Gade, and the Grand Junction Canal pass, and agreeably diversify the scenery.

Moor Park, two miles and a half from the Watford station, is the residence of the Marquis of Westminster. It is a magnificent edifice of the Corinthian order, surrounded by a finely wooded park, five miles in circumference.

From Watford, the railway proceeds in a direct line through an excavation in some places 60 feet deep, to the Watford tunnel, 170 yards in length, 24 feet wide, and 25 feet high. It is ventilated by six shafts, in the excavation of one of which, ten persons were buried and killed. From this point the railway runs for many miles nearly parallel with the old London road and the Grand Junction Canal. The old road has long been abandoned as a transit for great bulks of heavy merchandize, and the canal, which but the other day was looked upon as a splendid enterprize, and highly beneficial to commerce, is now rapidly yielding to the superior celerity of the railway conveyance.

(To be continued.)

TRADES UNIONS AND STRIKES.

ACCOUNT OF A STRIKE AT GLASGOW.

(From the Edinburgh Review.)

During the extravagant prosperity of the summer of 1836, the spinners had memorialized the masters for an advance of wages in consequence of the rise in the price of cotton goods which then took place. The wages of the spinners before this rise, were from thirty to thirty-five shillings a week; and after the rise, which the masters agreed to, they were from thirty-five to forty-two. In consequence however, of the commercial crisis of Ja-

nuary and February, 1837, prices fell so much that it became necessary to recall this advance; and the masters proposed in March, 1837, that wages should be restored to their previous rate. Even at the reduced rates, the spinners might make from twenty-six to thirty-six shillings a week. The workmen, however, unanimously refused to accede to these terms; and as the masters declined to give any higher, the former struck work in a body on the 8th of April, 1837. They did so on the avowed principle that they were entitled, and determined to keep up wages, during a period of unexampled gloom and depression, to the level which they had attained in one of unprecedented prosperity.

As the principle on which this strike was founded is one of singular importance, as illustrating the perversion of mind which conspiracy produces, we here subjoin the account of its origin, as given by one of the cotton-spinners themselves. It appeared in their own journal, the *New Liberator* of Glasgow, on the 13th of January, 1838.

"In the latter end of the year 1836, the cotton-spinners of Glasgow considered that an advance of their wages, amounting on the whole to a mere trifle, was not only just but practicable. The master cotton-spinner bought wool at nearly the rate he had formerly done, and was selling his yarn at least 35 per cent. beyond its former cost. The spinners memorialized their employers for an augmentation of wages, and the rationality of their claim being so self-evident, they succeeded with little difficulty, and without exercising any coercive measures whatever.

"Thus every thing went on harmoniously between the operative spinner and his master until the spring of 1837, but by that time the *frightful and every-way alarming stagnation of trade had set in—the manufacturer had little demand for the productions of the loom, and the weavers were thrown idle in thousands.* In consequence of this melancholy reaction in our commercial affairs, the *prices of yarns began to decline*, and the masters' first step, on being offered lower prices, was to reduce the spinners to the standard which existed *prior to the recent advance.* This step *was promptly and decidedly opposed by the operatives, who struck work in April*, 1837.

'In consideration of the deplorable circumstances of the times, the multitudes of unemployed peo le who were wandering in destitution about the city, and the many thousands of females, and of little children unemployed in the factories to be thrown idle—the strike was far from being popular; and perhaps *was exceedingly ill-timed*, but the fault, it must be admitted, was entirely attributable to the masters—nothing was left to the workmen but to submit to this aggression on their comforts, or resist it.'

The strike continued from the 8th of April, till the 5th of Augnst, being a period of 17 weeks and five days. It terminated at last by the spinners unanimously agreeing to return to their work, within three days after the ruling committee, had been arrested in a body for their alleged accession to the murder of Smith, in the streets of Glasgow, on 22d July; and the estimate, on the most moderate calculation, of the loss sustained by the cotton-spinners themselves—the persons employed under them,—their employers, and the community at large during the strike, is £194,540; of which sum, £78,540 was the direct loss of wages during the strike.

It may readily be conceived what must have been the sufferings of the operatives during the latter weeks of this disastrous strike. The aliment allowed by the Association to each man during the latter part of the strike was only *eightcenpence* a week. Such was the deplorable pittance to which the deluded operative was reduced, who refused, or was compelled by the committee to refuse during the whole time from thirty to thirty-five shillings a week! The condition of the female operatives—the piecers, pickers, carders, and reelers—was infinitely worse, for there was no fund whatever provided for *their* maintenance, and from the commencement they were thrown upon the streets without either asylum, employment, or subsistence.

SYMPATHETIC INKS.

Writing with inks of this nature is illegible, unless a chemical change be subsequently effected on them. Many amusing experiments may, therefore, be performed with inks of this description. A letter may be written with common ink, and another with sympathetic ink between the lines of the former. Drawings may also be made, which shall change their appearance: thus a picture representing a winter scene, may be made to change, and appear like summer, on the application of heat, and other re-agents; and a variety of similar effects can easily be produced. The following description of the manner of procuring a variety of these

inks will afford the student a selection on which he can exercise his ingenuity.

Silver Ink.—Write with dilute nitrate of silver (lunar caustic), which, when dry, will be entirely invisible; hold the paper over a vessel containing sulphate of ammonia, and the writing will appear very distinct. The letters will shine with the metallic brilliancy of silver.

Yellow Ink.—Write upon paper with a diluted solution of muriate of copper; when dry, it will not be visible, but on being warmed before the fire, the writing will become of a beautiful yellow colour.

Green Ink.—Write with a solution of muriate of cobalt, and the writing, while dry, will not be perceptible; but if held before the fire, it will then gradually become visible, and the letters will appear of an elegant green colour.

Blue Ink.—Write with acetate of cobalt, or with a muriate of cobalt, previously purified from the iron which it generally contains. When the writing has become dry, these letters will also be invisible. Warm the paper a little, and the writing will be restored to a beautiful blue.

Another Blue Ink.—Write with a weak solution of sulphate of iron, and, when dry, wash the letters with prussiate of potash, by dipping a feather in it, and lightly passing it over them: they will then appear of a beautiful blue.

Dark Ink.—Write on paper with a solution of nitrate of bismuth: when this is dry, the writing will be invisible; but if the paper be exposed to sulphuretted hydrogen gas, the words will be distinctly legible.

Black.—A letter written with a dilute solution of bismuth, becomes, when dry, illegible; but a feather dipped in a solution of sulphuret of potash will instantly blacken the oxide, and revive the writing.

Black.—Write with a solution of nitrate or acetate of lead. When the writing is dry, it will be invisible; then, having prepared a glass decanter, with a little sulphuret of iron strewed over the bottom of it, pour a little very dilute sulphuric acid upon the sulphuret, so as not to wet the mouth of the decanter, and suspend the writing, by means of the glass stopper, within the decanter. By an attention to the paper, the writing will become visible by degrees, as the gas escapes from the bottom of the vessel.

Black.—Write with a weak solution of sulphate of iron, let it dry, and it will be invisible. By dipping a feather in tincture of galls, and drawing the wet feather over the letters, the writing will be restored, and appear black.

Mix alum with lemon juice. The letters written with this ink will be invisible till dipped in water.

A letter written with common milk, or with the juice of an onion, may be deciphered, when held before the fire until the paper be singed.—*Dalton's Book of Experiments.*

Discovery of a Salino-Sulphureous Spring in the Vicinity of Bristol.—In sinking a shaft for a well a few days since, on the line of the Great Western Railway, between Bath and Bristol, the workmen came upon a spring which proves to be similar in its properties to those of Harrowgate, Moffat, St. Bernard's Wells, &c. Dr. Fairbrother has subjected some of the water to a slight examination, and is now submitting it to a more minute analysis. Amongst other tests, the Doctor found that on pumping on a piece of silver for a few seconds only, it becomes quite blackened—so strongly is the water impregnated with sulphur.

Subterranean Forest.—The capacious bonding-pond, which is now being excavated at South Stockton, has led to the discovery of an extensive subterranean forest. The timber is chiefly oak. A yew, tree of considerable size has been found, the wood of which is sound and good, and fit for the turner's lathe. Many of the oaks are of large dimensions, and the proprietors expect some of them will be suitable for the purpose of building. Whilst examining this forest Dr. Young, of Whitby, with some friends, discovered one of the oaks to have been cut in two, which had evidently been done previous to its being covered by the earth. The doctor supposes the forest may have been cut down by the Roman soldiers, as they were in the habit of laying timber on the low swampy grounds, for the purpose of making roads. Be this, however, as it may, it is certain the hand of man has been exerted on the timber, as it may form a fertile subject for the lover of ancient history and the geologist to speculate on.—*Durham paper.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, July 31, R. Addams, Esq., on Chemistry. Friday, August 2, W. H. Darker, jun., Esq., on the Properties of Light, particularly on Polarization, and the Hydro-oxygen Light as applied to Optical Purposes. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Wednesday-August 1, B. R. Haydon, Esq., on the Basis of Painting and Design. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, July 30, Mr. J. Burton, on the applications of Chemistry and Machinery. At a quarter to nine.

QUERIES.

1st. If a lever of the first order, 100 inches long, with the fulcrum 10 inches from its extremity, be loaded with 500 lbs. on its short arm, and balanced by 50 lbs. placed on the long arm, what weight does the fulcrum bear, supposing the weight of the lever itself is 0?

2nd. It is stated, in converting rectilinear to circular motion (as in the case of the beam and crank), loss of power is experienced; is it the same in the conversion of circular to rectilinear?

3rd. Are there any geological facts to ascertain the age of the earth, so as to agree with the Mosaic account? If so, what are they, and on whose authority?

4th. Are there any astronomical facts to prove the same?

5th. Required the cause of a scale turning when a person pushes against the scale-beam with his hands or a staff, although the opposite scale shall have a greater weight (than the person) placed upon it.

6th. Required the rule, method, or other formula, whereby the weight of the earth might be ascertained?

7th. Procure a circular disc perforated with a small hole and fitted exactly with a tube; now if a similar disc without the hole be placed on the one fitted with the tube and a strong current of air, steam, or water, be forced through the tube, the upper disc is not removed, on the contrary, it is the firmer fixed. What is the cause of this?

In Vol. II. of the then "Penny Mechanic," an answer was given to this query; it was to this effect, though not exactly the same words, for I quote from memory:—The air rushes out around the edges of the discs, and a vacuum is formed in the centre of the pressure of air outside, confining the upper disc to its place." Since then, experiments have proved the fallacy of this theory. The discs and tube were fitted under the receiver of an air-pump and the air exhausted. Now if the theory above stated were true, the air itself would have forced the discs asunder, in trying to regain its former place in the receiver, but with a powerful blast sent through the tube, the discs did not separate even in the exhausted receiver. D. J.

[1. It is evident that the fulcrum supports neither more nor less than the incumbent weights of 500 lbs. plus 50 lbs. = 550 lbs., without consideration of their relative positions and mechanical advantages. The distance of the lesser weight from the fulcrum will be 8 feet 4 inches, or ten times the distance of the greater weight, since there is always equilibrium when the weight, multiplied by its distance from the fulcrum, is equal to the power (or lesser weight, placed at the opposite extremity of the lever): thus $500 \times 10 = 5000$; and 50×100 (= 8 feet 4 inches) $= 5000$.

2. The statement is incorrect; no power whatever is lost in converting a rectilinear into a circular motion by means of the crank, as employed in a steam-engine, except the external impediments occasioned by friction, &c., which operate in some degree, whenever motion is transferred from one body to another. It is the same in converting a circular into a rectilinear motion. This mistake is very prevalent; it has probably originated from the circumstance of the force being unequally distributed, and also from the fact, that in some peculiar arrangements, considerable power is really lost. Such is the case when a circular motion is regulated by a train of wheels terminated by a fly, and a weight descends, or a spring unbends, while the crank is moving perpendicularly to the rectilinear motion; and, consequently, the power is expended upon the worm or pinion connected with the fly, and so much impulse is lost in the direction of the rectilinear motion.

(Queries 3 and 4 we will undertake to answer at length, and show that history, geology, and astronomy, combine to corroborate the Mosaic account of the creation. It may, however, be proper to state, that we shall do so without any direct reference to theological subjects, which, together with politics, are not discussed in this work).

5. Because, by so doing, the scale is forced farther from the centre, and, consequently, the weight acts at a greater mechanical advantage. If the scale were fixed to the beam by an inflexible body, no effect would be produced by pushing against the beam. In the Philosophical Transactions, No. 409, p. 306, is "A proposition on the balance (not taken notice of by mechanical writers) explained *and confirmed by experiment*," by Dr. Desaguliers. In this paper, erudite in appearance, the Doctor contends, that if a person in a scale were to press upwards against the beam at a point nearer the centre than that from which the scale is suspended, the scale would thereby be made to preponderate, even though an obstacle were placed to prevent the scale from projecting outwards from the centre, and, consequently, if it were attached by inflexible rods, the same effect would be produced. Now Dr. Desaguliers was one of the learned men of his day; the paper we have referred to, passed the ordeal of the Royal Society, was approved by the council, and ordered to be printed! It is gratifying to consider the progress of science since that time; at the present day, the humblest mechanic's institute would speedily reject a doctrine so manifestly fallacious and absurd, as to be unworthy of refutation, although supported by pretended experiment, and misapplied "*quid erat demonstrandum*."

6 We leave open for the present, hoping it may elicit something interesting from some of our scientific correspondents; we, however, take the liberty of suggesting, that *density* should be substituted for *weight*. The weight of a body is variable, depending upon the reciprocal action of other bodies; and it would be carrying suppo-

sition rather too far, to bring up the whole earth and weigh it on its own surface.

7 Is a very singular phenomenon; it has occupied the attention of many scientific men, and some explanations have been attempted, but without success. Take two circular pieces of card, about two inches in diameter, and in the centre of one of them make a hole to admit the end of a quill, which is not to project beyond the surface of the card; when the unpierced piece of card is laid close upon that which has the quill projecting from one side, it is found upon blowing through a quill, that the upper piece, instead of being blown off, as would be expected, adheres the more firmly the harder you blow. It is not at present in our power to give any *satisfactory* explanation of this curious fact; but we recommend its consideration to our ingenious readers. —Ed.]

What will destroy hair on the face and hands without injuring the skin?

A cheap and easy method of silvering the exterior of a brass musical instrument (cornet à piston), your observations on silvering in No. 24 (N. S), not being applicable, an early answer would oblige. Tyro.

A good receipt for the following:—Ginger-beer powders; lemonade powders; soda-water powders; also the process for making white wax? A Subscriber.

ANSWER TO QUERY.

In removing dark spots from lacquered work, the burnishers are to be kept wet with beer *while* in use; not *until* in use, as was stated by mistake in No. 157. J. E.

TO CORRESPONDENTS.

E. J. *and* W. R. L.'s *communications came too late for insertion in the present Number.*

J. B.—*The diameter of a circle being* 7, *the circumference is* 22 *(nearly); this proportion is accurate enough for ordinary purposes, as it only exceeds the true measure of the circumference a little more than one thousandth part of an inch in a circle of six inches diameter. When greater precision is required, the proportion may be taken,* 1 *to* 3.1416, *or* 3.14159; *if this is not sufficiently accurate, take the following:*—1 *to* 3·1415926535589793238462643383 27950288419716939937510582097494459230 78164062862089986280348253421170679821 48086513282306647093844609550582231725 3594081284802. *This is true to the hundred and fifty-fourth place of decimals; and in a circle large enough to encompass the earth, the error would be incomparably less than a thousand millionth part of the breadth of the finest hair. It is, in fact, nothing that we can conceive materially to exist. After the first* 20 *or* 30 *figures, although the progression continues according to fixed and known laws, the imagination can no longer keep pace with the march of calculation. The difference between the values of the* 150*th and* 154*th places, though one is ten thousand times greater than the other, cannot be conceived by the human mind, being both removed an immeasurable distance beyond the bounds of imagination.*

S. X.—*A railway curve of half a mile radius, is bad and dangerous. Curve lines should never be laid on a plane surface; if the velocity of the train were invariable, and the outward rail raised to the proper height above the inner one, the engine would have no inclination to quit the line of rail, since the force of gravity would incline it inwards, as much as the rectilinear tendency of its momentum would incline it outwards. This effect may be exemplified by a very simple experiment:—In a bowl, or any concave spherical surface, project a round smooth ball, as a shot, or marble, taking care that the impulse be given in the direction of a tangent to an horizontal circle; the ball will revolve in a circle, nearer to, or farther from the centre, according to the velocity of its projection. Now if a rail were formed in this circle, and a body moving upon wheels substituted for the ball, it is clear that that body, so long as its velocity is maintained by any force acting tangentially to the circular path, will move freely in the curve or circle, without tending in any degree to deviate from it. The great difficulty to be overcome in railway curves, proceeds from the inequality of the velocity of the trains; but assuming an average speed, and giving the rails a corresponding concavity, the inconvenience may be reduced to a small amount, unless the curve be of unreasonably short radius.*

E. N. Ward.—*If our correspondent will refer to No.* 152 *of the "Mechanic," he will perceive that the invention of a process for facilitating the manufacture of candles, is not of recent date; it was suggested by the Marquis of Worcester, in his Century of Inventions, but he did not divulge the method he proposed to employ.*

A. B. C. *will find the formulas and tables he requires, in any number of the Nautical Almanack. We cannot reproduce them here, there being an Act of Parliament now in force, which prohibits their publication in any other work than the authorised edition of the Nautical Almanack, published by Murray, in Marlborough-Street. The subject of calculating the latitude and longitude at sea by astronomical observations, is not of sufficiently general interest to justify its admission into our columns; if* "A. B. C." *finds any difficulty in obtaining the information he requires, we will supply it by a private communication.*

Errata.—No. 157, p. 278, col. 2, line 4, for $\frac{1}{000}$, *read* $\frac{1}{100}$; line 8, for $\frac{1}{999}$, *read* $\frac{1}{199}$; line 13, for 3.2108902, *read* 3.2108992.

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THE

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Nos. XXXVIII. & XXXIX. NEW SERIES. | SATURDAY, AUG. 3, 1839. (PRICE TWO PENCE.) | Nos. CLIX. & CLX. OLD SERIES.

PIESSE'S APPARATUS FOR PRESERVING BUTTER AND CREAM.

Fig. 1.

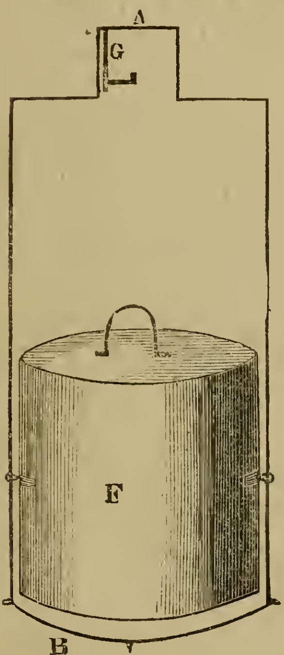
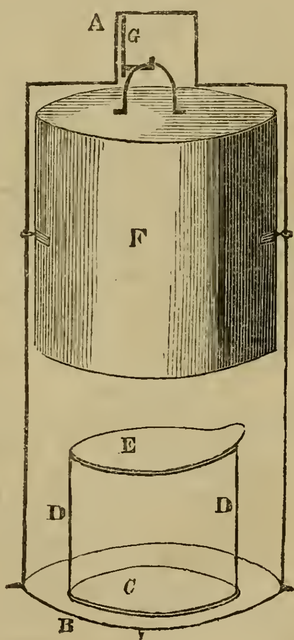


Fig. 2.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney,

PIESSE'S APPARATUS FOR PRESERVING CREAM AND BUTTER COOL IN HOT WEATHER.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Should you think the following description of an improved butter and cream cooler worthy of your notice, would you be kind enough to insert it in your valuable magazine?

A, figs. 1 and 2, is a stout iron wire, bent in the form of the drawing; it must be tinned, to prevent it from rusting. This must be attached to the disk of tin B; C, fig. 2, is a plate supported by a ring of tin, about half an inch broad, soldered to B; D D, have a ring attached to them, which supports a pan or dish, like an evaporating dish used by chemists; D B, of course, is made fast to B; F is a bill which, when detached from the hook, G, drops over the pan and plate, as is seen in fig. 1; it is to be made of zinc, with the exception of the top, which must be of lead, to keep it from rising in the water while in use.

To use this cooler, the butter is to be put into the plate, and the cream or milk into the pan; the bill is then to be dropped over them, and the whole immersed in a pail of water; thus the butter will be kept in a cool atmosphere, and the cream prevented from turning acid. It is to be made of zinc, and then painted. I am aware that there is something of this description made, but it does not hold cream. The top takes right off: it is made of iron, which gets rusty.

I am, Sir, yours,

Juvenile Entertainer.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 277.)

Boxmoor Station, on Boxmoor, is the point to which the railway extended at its first opening from London; it is now, only a minor, or intermediate station, distant from London $24\frac{3}{4}$ miles, from Birmingham $87\frac{1}{2}$ miles.

About two miles from Boxmoor, is Hemel Hempstead, a small market town, 23 miles from London. It is a remarkably quiet place, being situated a mile and a half from the main road. The church appears to have been built about the time of the Norman conquest.

Two Waters, a village twenty-two miles from London, is situated on the banks of the Bulbourn Brook, and the river Gade; it is chiefly remarkable for its paper-mills, one of which, Nash Mill, is a very extensive and complete establishment, and well worthy of a visit. The junction of the waters at this place, formerly attracted great numbers of anglers, but the water is now so contaminated with the pernicious ingredients used in the manufacture of paper, that both fish and fishermen have abandoned the place; some few of the latter, however, still frequent their favourite spots, notwithstanding the absence of the fish, and enjoy erudite, though unproductive angling.

Berkhampstead Station, $27\frac{3}{4}$ miles from London, $84\frac{3}{4}$ from Birmingham. In the vicinity of Berkhampstead are the following seats: — Haresfoot, T. Dorrien, Esq.; Ashlin's Hall, J. Smith, Esq.; Bartlett's, late Mrs. Pechell; and Berkhampstead Place, Hon. Miss Grimston.

Berkhampstead is a handsome and ancient town, pleasantly situated in a deep valley, in a hilly country, whence its name is supposed to be derived; Berghamstede, the name given to it by the Saxons, signifying a town amongst the hills. The town consists chiefly of one long irregularly-built street, and a branch leading from the church towards the ruins of the ancient castle. A market is held on Saturdays, and fairs on Shrove Monday, Whit-Monday, Aug. 5, and Oct. 11, for cattle and cheese. A considerable quantity of straw plat is manufactured here, which affords employment for a great number of females.

At the time of the Norman invasion, Frederick, Abbot of St. Alban's, a relative of King Canute, impeded the progress of William the Conqueror, by causing trees to be felled by the roadside, and laid across the way. He was not allowed to continue his march in this direction until he had sworn on the Gospel, and the reliques of St. Alban's Church, that he would not violate the ancient laws of the kingdom; these oaths he, however, broke when his power was finally established, for he took away all their lands, and gave them to his followers—a truly royal gift, since in those days, and even in more recent times, in some countries, kings alone have the privilege of giving away that which does not belong to them. The castle was once an important and formidable place of defence; the double ditch and ramparts of earth with which it was once surrounded, still remain; the sides of the outer rampart are now planted with trees, and it forms an agreeable promenade of about 1,700 feet in circuit, ex-

tending nearly the whole distance round. Within the second rampart may be traced the remains of the castle walls, which are of great thickness, and, in their present dilapidated condition, are from 18 to 24 feet in height. They are composed of flints and mortar, forming a mass of great strength, and its present existence, after the lapse of a thousand years, sufficiently proves its durability; but its glory is past; the encroaching ivy waves its gloomy wreaths, where once floated the proud banners of the Mercian kings; the owl is the warder, and the bat is the herald, to usher the stranger into the sepulchral ruins of the crumbling halls, where

> "The lonely spider's thin grey pall,
> Waves slowly wid'ning o'er the wall."

The church, dedicated to St. Peter, is a large ornamented gothic building, consisting of a square embattled tower, a nave with two aisles, and two chapels. A number of curious and interesting sepulchral memorials, of ancient date, are found in various parts of the church. There are two inscriptions in old English (black letter), one dated in the first year of the reign of Henry VII. (1485); the other in the 12th of Henry VIII. (1521); the first records the death of Robert Incent, who fell a victim to an epidemy which is designated "The grete Swetyng Sykenesse;" the other is on the tomb of his wife, who died by the same malady. This epidemy is mentioned by Hume, who says, that in the year 1485, "There raged at this time in London, and other parts of the kingdom, a species of malady unknown to any other age or nation, *The sweating sickness*, which occasioned the sudden death of great multitudes; though it seemed not to be propagated by any contagious infection, but arose from the general disposition of the air, and of the human body. In less than twenty-four hours the patient commonly died or recovered; but when the pestilence had exerted its fury for a few weeks, it was observed, either from alterations in the air, or from a more proper regimen which had been discovered, to be considerably abated." In the chapel on the north side of the nave there is a monument of apparently great antiquity, though no inscription can be found to tell the date of its erection, or to whom it belonged. It consists of an altar tomb supporting the recumbent figures of a knight in armour, and a lady; the feet of the former are supported by a lion, and the feet of the lady by a dog. The shields on the east end of the tomb bear the same arms as another monument in the aisle, on which is an inscription in brass, to the memory of Richard Torrington, and Margaret his wife; which clearly indicates that either the knight or his lady belonged to that family.

About a mile from Berkhampstead, on the road to Tring, is the parish of Northchurch, or St. Mary's, Berkhampstead; which is celebrated for having been the place of abode of "Peter the Wild Boy," In the church-yard there is a tomb bearing a simple inscription to his memory; but a brass tablet is placed within the church, on the eastern wall, on which is engraved his portrait and this inscription:—

"To the memory of Peter called the Wild Boy, who being found wild in the forest of Hertswald, near Hanover, in the year 1725, he was then supposed to be about twelve years old. In the following year he was brought to England by order of Queen Caroline, and the ablest masters were provided for him; but proving incapable of speaking, or of receiving any instruction, a comfortable provision was made for him by her majesty at a farm-house in this parish, where he continued to the end of his inoffensive life. He died on the 22d of February 1785, supposed to be aged 72."

The story of Peter excited great interest and curiosity during his lifetime, and even at the present day it is a prevalent opinion that he was a phenomenon exhibiting the effects of a savage and isolated life in early youth; but the more penetrating physiologist pronounces him a mere natural idiot.

A brief sketch of his life and habits may nevertheless be amusing to many readers, as the world considers him a wonder; we conform to the world, for the very sufficient reason, that it will not conform to us.

In 1725, the hounds of George I. found Peter wandering in the forest of Hertswald, and pursued him as they were accustomed to pursue the game. He was naked, with the exception of a shirt collar about his neck; when he could no longer elude the dogs, he took refuge in a hollow tree, where he was taken and secured.

(To be continued.)

DISCOVERY OF A ROMAN URN, AND COINS.

The following paper on the subject of some interesting relics of antiquity recently discovered at Bredicot, near Wor-

cester, was read at the Worcestershire Natural History Society, on Tuesday last:—

"As some workmen were lately excavating on the line of the railroad in the parish of Bredicot, they found, at the depth of about two feet in the earth, under the spreading boughs of a very large and ancient pollard elm, just by Bredicot Court, a small Roman urn, of red clay, which is four inches and an eighth high, eleven and a half inches round the middle of it, six inches round the neck, and four inches round the foot. Its shape is like a skittle. I am informed there were about 140 small copper coins in it, which were distributed amongst the workmen; but the urn and 45 of the coins having been kindly procured by Henry Chamberlain, Esq., of the above court, I find after clearing them of much oxidation, that they are all Roman, and that the heads upon 43 of them have the iron crown; one of the others is quite undecipherable, except the P. F. AVG., and the remaining one has the head of a female with a helmet on, and the termination of her superscription is ( ) LONINA AVG., but the other letters which were upon the obverse of it are obliterated; the reverse however has a stag and the letters IVNONIG (or C) O ( ).

Some of the 43 coins I have been enabled to decipher as follows, namely:—

EMPERORS.

	( )ODINVS	P. F. AVG.	1 coin.
	GALLIENVS	AVG.	6 do.
IMP.	CLAVDIVS	AVG.	6 do.
	DIOCL.( )		1 do.

USURPERS IN BRITAIN, &c.

IMP.	PO( )S	AVG.	1 coin.
IMP. C	VICTORINVS	P. F. AVG.	7 do.
IMP.	TETRICVS	P. F. AVG.	17 do.
IMP.	CARAVSIVS	P. F. AVG.	3 do.

The letters ( ) ODINVS and DIVOCL ( ) no doubt are part of the names of the Emperors Commodus and Dioclesian, and the PO( )S of the Usurper Posthumus; and I presume the above coins of Claudius are all of the second Emperor of that name, as two of them have G for Gothicus as the surname. It is perhaps worthy of remark, that there are not any two of these coins of the same mintage.

Bredicot Court is situated about a mile from Elbury Hill; upon which there are vestiges of a Roman Camp, as described in my former paper of the 5th of Nov. last."

A NEW METHOD TO TEACH LATIN FLUENTLY IN TWO YEARS' TIME.

A GREAT discourse was some months of a child at Paris, of four years old, speaking Latin as other infants do their mother tongue; the King hearing of it was willing to see it, and it caused wonderful admiration from him and all the court. I myself discoursed it some hours, and did not hear an improper word.

1. It had no other rules of language than this, use and conversation; the father thereof being so happy to find two friends honest and able, who asked it of him upon its being weaned. It is evident that nothing was omitted by them that might be of use, either for giving it the purity of the language or possessing it with good manners. Manners, in speaking to it with discretion, and removing evil examples, and presenting it with nothing but what was harmless; and purity of speaking, and language, in using only proper and fit words, and in reprehending it, corrected those that spoke false. Now, the success of this education is desired for the good of all; the Latin tongue being so difficult to attain in the common way of teaching it; and I question not, but many will be of my opinion, though they may not be in a condition to put them in practice, for want of persons capable to make such an attempt successful.

2. This way of teaching is both very ancient and infallible. For first, nobody is ignorant, that from the world to this day every one has learnt his mother-tongue without rules, and spoke it better than other. Secondly, as to foreign languages, all know that the shortest, speediest, and easiest way of learning, is to give unto the countries where they are vulgar, where rules are needless to learn them. And I will not say that good natural parts hath much helped them; for that children, whether sprightly or no, learn almost equally well their mother-tongue. And that child at Paris, I observed nothing in him more than a habit of reasoning and docibleness, that proceeded from the manner which those that had taught him lived and conversed with him in. And I am more confirmed by the example of two other children very young, that were educated in the same way, that have almost nothing childish in them, but the motions and gayness that are inseparable from that age.

Montaigne's father had him taught thus, by imposing silence on all about his son, those excepted that could speak Latin to him. If it be thought that this

way will cause great expenses, being to have several Latinists with your children, the number of children will make that easy, and these doubts are easily satisfied when one sees the thing done, for often they are found more easy, and more natural, the more pains they have cost to do them.

The great importance to all people the Latin tongue is, needs not be insisted on; but the common way of learning it, makes it hard to be attained; for we prefer the knowledge of words to that of things, which is a great evil, and yet it doth not conduce to teach us, even the language we have sacrificed all unto; therefore I am for establishing an ancient, tried, easy, short, and commodious way for the knowledge of things as well as words.—*A Thousand Notable Things.*

KATER'S CONVERTIBLE PENDULUM.

It is a well-known property of the pendulum, that in a given latitude the times of vibration in small arcs are equal, when the distance from the centre of suspension to the centre of oscillation is invariable, whether the weight suspended be lighter or heavier. The length of a pendulum, vibrating a given number of times in any portion of time, accurately defined by some of the permanent phenomena of nature, has often been proposed as a permanent standard of measure; great difficulty was, however, encountered in ascertaining the exact situation of the centre of oscillation, till the difficulty was triumphantly solved by Captain Kater. The first idea which presented itself, was to suspend a spherical ball by a very fine string, and find the centre of oscillation by calculation; it was, however, found that the instability of a thread, nearly imponderable, and other practical impediments, caused the failure of this experiment. A cylinder of brass or iron was next resorted to, and appeared well adapted to the purpose; but the impossibility of obtaining a rod of metal so perfectly cylindrical and homogeneous in its texture, that the centre of oscillation could be determined by calculation alone, would have rendered this experiment equally fruitless, had it not occurred to the indefatigable Captain Kater, that there was a property of the centre of oscillation by which its exact situation might be found, by experiment, without the aid of calculation, whatever may be the irregularity in the figure, or in the density of the vibrating body.

It was first demonstrated by Huygens, that the centres of oscillation and suspension are convertible with each other; that is, if, in any pendulous body, the centre of oscillation be converted into the centre of suspension, the point which was previously the centre of suspension, will become the centre of oscillation, and, consequently, the times of vibration will remain the same from whichever point the body be suspended, and the real length of the pendulum is thus accurately obtained.

The following is the author's own description of his convertible pendulum:—

"The pendulum is formed of a bar of plate brass, one inch and a-half wide, and one-eighth of an inch thick. Through this bar two triangular holes are made, at the distance 39·4 inches from each other to admit the knife edges that are to serve for the axes of suspension in the two opposite positions of the pendulum. Four strong knees of hammered brass, of the same width with the bar, six inches long, and three quarters of an inch thick, are firmly screwed by pairs to each end of the bar; so that when the knife edges are passed through the triangular apertures, their backs may bear steadily against the perfectly plane surface of the brass knees, which are formed as nearly as possible, at right angles to the bar. The bar is cut of such a length that its ends fall short of the extremities of the knee-pieces about two inches.

"Two slips of deal, 17 inches long, are inserted at either end, in the spaces thus left between the knee-pieces unoccupied by the bar, and are firmly secured by screws. These slips of deal are only half the width of the bar; they are stained black, and a small whalebone point inserted at each end indicates the extent of the arc of vibration.

"A cylindrical weight of brass, three inches and a-half in diameter, and weighing about two pounds seven ounces, has a rectangular opening in the direction of its diameter, to admit the knee-pieces of one end of the pendulum. This weight, being passed on the pendulum, is so firmly screwed in its place, as to render any change impossible.

This weight, it must be observed, is not between the knife edges, but it is very near to one of them.

"A second weight, of about seven ounces and a-half, is made to slide on the bar, near the knife edges, at the opposite end; and it may be fixed at any point on the bar by two screws, with which it is furnished. A third weight, or slider, of only four ounces, is moveable along the bar, and is capable of nice adjustment, by

means of a screw and a clasp. It is intended to move near the centre of the bar, end has an opening, through which may be seen divisions of twentieths of an inch engraved on the bar."

NATURAL HISTORY.

Van Amburgh and his Menagerie.—The Vampire.—The Dog-cart Nuisance.—A disconsolate Widow.

Mr. Van Amburgh and his Menagerie.—On Monday last, this gentleman made his *debut* at the Clifton Zoological Gardens, and fully realized the great expectations which had been formed of his feats. During the exhibition of Tuesday, the spectators of Mr. Van Amburgh's interesting performance were much scandalized by several attempts on the part of the leopardess (in the division with the noble Barbary lion and lioness) to estrange his majesty's affections from his royal consort. The mortified vanity of the fair wearer of the spotted robe, at length sought relief in a rash attack upon the king of the forest, whose face soon streamed with blood. Roused at length, the noble animal seemed determined to destroy his assailant, when Mr. Van Amburgh rushed into the den, and by a heavy blow on the lion, saved the poor leopardess from destruction. On the same evening, during the performances, Mr. Vam Amburgh met with a slight accident, which has incapacitated him from appearing before the public for a short time. As the occurrence has been exaggerated into a statement that he received a severe and dangerous laceration in repelling an attack of one of the lions, we think it right to state, from good authority, that the lion's claw accidentally pierced the palm of Mr. V. A.'s hand, and some febrile irritation having ensued, it was thought advisable that for some days he should not expose himself to the extreme personal exertion which his performances demand.—*Bristol Paper.*

The Vampire.—Much curiosity was excited on Saturday among the loungers in St. Katharine's docks, by a report of the arrival of a real living vampire. So many horrible associations are connected with the popular ideas of this extraordinary animal, that a most intense desire was manifested to obtain a peep at it, and the vessel was crowded during the day, by hosts of curious visitors, until the animal was removed to the Surrey Gardens, to which establishment it was consigned. It is the sumatran species, and the first living specimen ever seen in England. It well deserves the name of *Vespertilio Spectrum*, given to it by Linnæus, remaining constantly suspended to the roof of his cage by the immense hooks at the edges of the wings, his head hanging downwards, and his eyes glistning with most vivid brightness. D'Azara, the celebrated naturalist, states that the vampire will attack horses, mules, asses, horned cattle, and the crest of fowls, who generally die in consequence, as a gangrene is engendered in the wounds. Even man himself is not secure from these insidious assaults, as D'Azara says he can bear very faithful testimony, having had the ends of his toes four times phlebotomized gratis, by this nocturnal surgeon, while sleeping in the cottages in the open country. The wound is not felt at the time of its infliction, as the blood is withdrawn by the most gentle suction, entirely from the capillary vessels of the skin, and not from any of the veins or arteries. and the victim is besides lulled into a deep slumber, by the flapping of his destroyer's wings, who thus enjoys his banquet undisturbed.

The Dog-cart Nuisance.—Mr. Estcott, the parish surgeon of St. Pancras, said yesterday, pending an inquest held before Mr. Wakley, on a man who died of hydrophobia, that he was astonished such terrible maladies were not of more frequent occurrence, in consequence of the daily increasing reprehensible practice of making dogs draw heavy loads in carts and trucks. Mr. Wakley said, the practice could not be too much discountenanced, and he was glad to see that a clause had been inserted in the new Police Bills, by which a severe penalty could be inflicted on those who employed dogs as beasts of draught. The clause would come into operation on the 1st of January next. Some days back, seeing two dogs in a cart heavily laden, and perceiving them panting and almost out of breath, he alighted from his cab for the purpose of examining them. He found them muzzled so tightly, that they could scarcely move their tongues, and as the skins of dogs were not sufficiently porous to admit of free perspiration, and the glands of their mouths being the chief organs of perspiration, the effects of tight muzzling, especially when the animals were hard worked, strongly tended to produce canine madness. Besides, the reckless and cruel way they were driven about the streets, caused daily accidents.

A Disconsolate Widow.—A short time since, we announced the death of Old Jack, the gigantic and venerable swan so well known in St. James's Park, and we have now to record the demise of another

swan, the consort of Old Jack, and for many years his inseparable companion. The old hen, though not so aged as poor Jack, was supposed to be above sixty years old, and to have been hatched about the year 1778. She first broke the shell at Frogmore, and was reared in the grounds of that beautiful retreat, under the immediate auspices of King George III. and Queen Charlotte, both of whom always manifested an extraordinary degree of interest in the rearing of these magnificent birds. The Queen in particular paid great attention to the breed of swans, and by her special directions, convenient buildings were erected in the pleasant gardens at Frogmore for their reception. Old Jack's consort was known by the familiar name of Jenny, and was placed in the canal of the ornamental gardens of St. James's Park, shortly after they were laid out in their present form, and soon got on terms of great familiarity with Old Jack, and a mutual attachment existed between them up to the time of his demise. They were often seen together on the water, rearing their snow-white necks, and looking out for biscuits from the promenaders. After the melancholy demise of the venerable swan Old Jack, at the advanced age of seventy years, his consort pined, and evidently felt very keenly the loss of her companion. She refused her customary food, left her usual haunts, and appeared bourn down with grief. She continued to pine away for several weeks, and expired in a kind of fit on Sunday morning, surviving her mate only three weeks. The body was sent to the Ornithological Society, in Museum-street, Bloomsbury, to be preserved. Like Old Jack, poor Jenny was terribly annoyed at the introduction of shoals of foreign interlopers on the canal, and whenever her lord and master gave battle to the intruders, she most valiantly took part in the fray. Like other ladies, she was at times "coy and hard to please," and frequently manifested a desire to "wear the breeches." On these occasions Old Jack enforced his lordly supremacy by administering a little wholesome correction, such as seizing her by the neck and forcing her head under water for a few seconds, and beating her with his wings. There are, at the present time, only two full-grown swans and three cygnets in St. James's Park.—*London Paper.*

Alarm Gong.—A very ingenious instrument has been invented by Capt. G. Smith, R. N., intended to give warning of the approach, and to announce the course a steamer is sailing on in a fog. It consists of a gong, on which a hammer is made to strike, every 10 seconds.

A Bottomless Meadow.—As the line of the Glasgow and Ayrshire Railway crosses from Ayrshire into Renfrewshire, there is a meadow, about three miles long, belonging to Mr. W. Patrick, W. S., through which it has to pass, and where it has to be embanked four or five feet high. The contractors lately entered upon it, and commenced the embankment, but were not a little surprised to find that their labours, like those of Tantalus, threatened to be of an endless nature; as, after having embanked 30 yards, they found that about 10 had sunk or subsided below the level of the line. They next day repeated their work, re-forming the embankment to the ordinary level; but, strange to say, the undersoil again gave way; and although they have since continued day and night to heap earth upon the spot, having put about 330 square yards upon a surface not exceeding 36 feet, the greedy bowels of the meadow receive it as fast as it is applied; and the workmen are now, not without reason, despairing of finding a solid foundation. This most singular phenomenon attracted a party of engineers to the spot on Saturday week, who could account for it in no other way than that the meadow is floating on water; which supposition seems the more feasible, that the ground rises on each side the sinking portion, and splits into deep cracks or hags. The people of the district have flocked in hundreds to have ocular demonstration of the above facts.—*Glasgow Courier.*

Statistics of Deaths—From the first report of the Registrar-General of Births, Deaths, and Marriages, the following is taken:—A comparison of the mining of Staffordshire, and Shropshire, and of Northumberland and Durham, with the rural districts surrounding each, exhibit great difference, especially in the proportions of death in old age. A very marked diversity also appears in the proportions of deaths of infants in different parts of the country. In the mining parts of Staffordshire and Shropshire, in Leeds and its suburbs, and in Cambridgeshire, Huntingdonshire, and the lowest parts of Lincolnshire, the deaths of infants under one year have been more than 270 out of 1000 deaths at all ages, while in the northern counties of England in Wiltshire, Dorsetshire, and Devonshire, in Herefordshire, and Monmouthshire, and in Wales, the deaths at that age, out of 1000 at all ages scarcely exceeded 180.

ALMANACKS AND THE WEATHER. ANCIENT ALMANACKS.

When we consider the accumulated mass of knowledge which in the present age is almost hourly developing itself; and the still increasing facility of access to scientific books and scientific institutions afforded to every class; books and institutions in which the deepest subjects are studiously deprived of the technical, abstruce, and pedantic forms, which formerly veiled them from the understanding of the uninitiated and unlearned; a better result might have been expected, than crowds of ignorant and superstitious people, in the very heart of the metropolis, contending which shall be first served with a "Weather Almanack." Before we proceed to expose the fraud of these productions, a short history of early almanacks may not be uninteresting to our readers. We are indebted for the following to a clever annual, known by the modest title of "Companion to the Almanack."

The early history of almanacks is involvin much obscurity. The Egyptians, indeed, possessed instruments answering most of the same purposes; but the log calendars are the most ancient almanacks, properly so called. Verstegan derives their name from a Saxon origin, viz., *al-mon-aght*, or the observation of all the moons, that being the purpose for which they were originally made: an eastern origin would appear to me to be more probable. They are doubtless of high antiquity, and, if we can be guided by the errors of the more modern ones in their ecclesiastical computation, we might refer them to the second or third century. Gruter has delineated one at Rome, and which is said to have been used by the Goths and Vandals: this was cut in elm, though most are in box, and some few in fir, brass, horn, &c. Each of these calendars contains four sides, for the four quarters of the year, and gives the golden numbers, epacts, dominical letter, &c. The numerical notation is imperfect but curious; dots are put for the first four digits, a mark similar to the Roman numeral V, for five; this mark, and additional dots for the next four, and the algebraical sign × for ten. Specimens of these logs may be seen in the British Museum; and, as they are not uncommon, it is unnecessary to enter into further detail.

Before I commence with written almanacks, it will be necessary to remark the distinction between astronomical and ecclesiastical calendars, the first of which contain astronomical computations, and the other lists of saints' days, and other matters relative to the church; sometimes, indeed, both are found united, although the latter claim a higher antiquity, being prefixed to most ancient Latin manuscripts of the Scriptures.

The folding calendars were, perhaps, the most ancient forms of them, and merit particular attention. Several of these are in the British Museum, and at Oxford; one of them was written in the year 1430, and is in English; but the writer confesses his inability to find suitable expressions for the technical terms which were derived for the most part from the Arabic, "for defawte of terms convenyent in our moder language." In the Pepysian library at Cambridge, there is one printed by Wynkin de Worde, in octo-decimo, which, in its original form, folds up from a small folio sheet of vellum; it bears the date of 1523.

The Standard almanacks emanated from Oxford, the seat of British science throughout the middle ages: in fact, before Newton's time, Cambridge was a blank, and the only scientific names that cheer the pages of the history of its early literature, are Holbroke of St. Peter's College, Buckley of King's, and Dee of St. John's: the first known by his astronomical tables, the second by a plagiarism of a method of extracting the roots of fractions from Robert Record, and the third a memorable instance of one of the greatest men of his time, uniting the pure truths of science with the grossest absurdities. All three were astrologers, owing, perhaps, more to the place of their education, than to the individuals themselves.

There has been some dispute relative to the authenticity of Roger Bacon's calendar, of which there is a MS. in the British Museum: the following is an exact transcript of the commencement:—

"Kalendarium sequens extractum est a tabulis tholetanis. anno domini. 1292. factus ad meridiem civitatis tholeti que in Hispania scita est cujus meridianus non multum distat a meridiano medii puncti Hibernie in quo. 3. continentur." f. 2.

If we retain *factus*, it cannot be translated, but, fortunately, the other MS. at Oxford has *factum*, and this must evidently be the true reading. Professor Peacock writes *factis;* but there is not, as far as I know, any MS. authority for it. With respect to the author of it, the Bodleian MS., in a coeval rubric, states the calendar to have been written *à fratre Rogero Bacon;* while the Cotton MS., not having any original title, is ascribed to Roger Bacon, in a hand of the 17th cen-

tury: both of the MSS. belong to the 14th century. In the Harleian collection (No. 941) is a MS. on the length of the days throughout the year, stated to have been "made at Oxynforde be the new kalendere and proved in all the university;" this "new kalendere" may possibly refer to Roger Bacon's; but there are not sufficient data to enable us to attain an approach to certainty.

The calendar of John Somers, of Oxford written in 1380, was one of the most popular of the time: there is generally appended to it, *Tabula docens algorismum legere, cujus utilitas est in brevi satis spatio numerum magnum comprehendere. Et quia numeri in kalendario positi vix excedunt sexaginta, ultra illam summam non est protensa.* Several English translations of this tract are among the Ashmolean MSS.

We have likewise in MS. "Almanach Profacii Judei," which is very ancient. Walter de Elvendene wrote a calendar in 1327, and Nicholas de Lynna published another in 1386. Sometimes these calendars are found in rolls.

In the library at Lambeth Palace is a very curious calendar in the English language, written in 1460; at the end is a table of eclipses from 1460 to 1481; but a very perfect volvelle is most worthy of notice, because those instruments are generally found imperfect. In the Cottonian collection is another English calendar, written about 1450, but so much damaged by the fire, that the nature of it cannot be seen. In Trinity College, Cambridge, there is a MS. said to have been composed in 1347, and entitled, "An Almanack, translated in perpetuite, out of Arabike into Latin;" and in the same library I find "The Effemerides of John of Mounte Riol," a German "Prince of Astronomyers." Professor Leslie mentions a very beautiful calendar in the library of the university of Edinburgh, with the date of 1482: he does not appear to be aware that they were common in MS. libraries, and he greatly overrates its value.

There was printed at Hackney, in 1812, a small octavo volume, containing an account of an English almanack for the year 1386: it contains a very large portion of astronomical and medical matter, but appears to be of little interest, save that it is the earliest one in English I have ever heard of. The contents of this calendar are as follow:—

1. The houses of the planets and their properties.
2. The exposition of the signs.
3. Chronicle of events from the birth of Cain.

In 1325 there was a "grete hungur" in England; in 1333 a great tempest; in 1349 the first, in 1361 the second, and in 1369 the third pestilence. It is curious to remark the clumsy method of expressing numbers consisting of more than two figures: for instance, we have 52mcc20 put for 52,220. This shows that the Arabic notation was even then but imperfectly understood among the common people.

4. To find the prime numbers.
5. Short notes on medicine.
6. On blood-letting.
7. A description of the table of the signs and moveable feasts.
8. Quantitates diei artificialis.

The extracts from this calendar are wretchedly transcribed, and evidently by one who was totally unacquainted with MSS.

The clock or albion of Richard de Wallingford, of St. Alban's, answered the purpose of a calendar. This clock made, says Bale, who appears to have seen it, *magno labore, majore sumptu, arte vero maxima*, was considered the greatest curiosity of its time. In his account of it, which still remains in manuscript, we have the following definitions,—"Albion est geometricum instrumentum: almanac autem arithmetricum." Peter Lightfoot's celebrated astronomical clock at Glastonbury may have been something of the same sort.

Peter de Dacia, about 1300, published a calender, of which there is a very early MS. in the Lavilian libary at Oxford: the "condiciones planetarum" are thus staten—

> "Jupiter atque Venus boni, Saturnusque malignus:
> Sol et Mercurius cum Luna sunt medioeres."

The "homo signorum," so common in later calendars, probably originated with him.

The earliest almanack printed in England was the "Sheapeheard's Kalender," translated from the French, and printed by Richard Pynson, in 1497. It contains a vast portion of extraneous matter. The following verses on the planets will, at the same time, give a good idea of the nature of the astrological information in this and other calendars of the period:—

> "Some hot, some colde, some moyst, some dry,
> If three be good, foure be worse at the most.
> Saturne is hyest and coldest, being full old,
> And Mars, with his bluddy swerde, ever ready to kyll;
> Jupiter very good, and Venus maketh lovers glad,

Sol and Luna is half good and half ill,
Mercury is good and will verily,
And hereafter shalt thou know,
Whiche of the seven most worthy be,
And who reigneth hye, and who a lowe;
Of every planets propertie,
Which is the best among them all,
That causeth welth, sorrowe, or sinne,
Tarry and heare sone thou shalt, ·
Speake softe, for now I beginne."

Afterwards follow some prognostications of the weather. The following method "to knowe what wether shall be all the yere after the chaunge of every moone by the prime dayes," is taken from a MS. in Lambeth Palace :—

"Sondaye pryme, drye wether.
Mondaye pryme, moyst wether.
Teusdaye pryme, cold and wynde.
Wenesdaye pryme, mervelous.
Thursdaye pryme, sonne and clere.
Frydaye pryme, fayre and fowle.
Saturday pryme, rayne."

Prognostications of the weather were early matters of reproach :—

"Astronomoers also aren at ere whittes ende,
Of that was calculed of the clymat the contrye thei fyndeth."

And in Heber's library was a little tract of three leaves, entitled "A Mery Prognostication":—

"For the yere of Chryste's incarnacyon,
A thousande fyve hundreth fortye and foure.
This to prognosticate I may be bolde,
That whan the new yere is come, gone is the olde."

Henry VIII. issued a proclamation against such false prognostications as this tract was intended to ridicule, but still no printer ventured to put his name to it. Not long after to believe them was a crime; "as for astrologicall and other like vaine predictions or abodes," says Thomas Lydiat, "I thanke God I was never addicted to them."

Johannes de Monte-Regio, in 1472, composed the earliest European almanack that issued from the press; and, before the end of that century, they became common on the Continent. In England they were not in general use until the middle of the sixteenth century. Most of the best mathematicians of the time were employed in constructing them; but, before the end of the following century, almanack-makers began to form a distinct body, and, though they often styled themselves "studentes in the artes mathematicall," very few of them were at all celebrated in the pure sciences.

It may not be wholly irrelevant here to make some few observations on the memory-rhymes found in some almanacks of the present day, and which date their origin to a much earlier period. The well-known lines, used by many for recalling to their recollection the number of days in each month, I find in Winter's Cambridge Almanack for 1635, under the following slightly-varied form :—

"Aprill, June, and September,
Thirty daies have as November;
Ech month else doth never vary,
From thirty-one, save February;
Wich twenty-eight doth still confine,
Save on Leap-yeare, then twenty-nine."

And the nursery-rhymes, commencing "Multiplication is my vexation," were certainly made before 1576.

The early history of ecclesiastical computation is intimately connected with that of calendars. Dionysiuus Exiguus was one of the first who wrote on the subject: after him, Bede, Gerlandus, Alexander de Villa Dei, and Johannes de Sacro-Bosco, were the most celebrated. The Massa Compoti of Alexander de Villa Dei, so common in MS., is perhaps the most singular tract on the subject that has come down to us: his reason for the title of the book is exceedingly curious :—*Sicut de multis laminis æris in conflatorio massa una efficitur, ideo librum istum vocari volui massam compoti.*

I cannot conclude without mentioning the "Almanac and Prognostication" of Leonard Digges, which was so often reprinted in the latter half of the sixteenth century: it is filled with the most extravagant astrological absurdities, and a table of weather predictions. With respect to the latter, however, I have had the curiosity to test its accuracy for some months in comparison with our two celebrated weather almanacks, and, on the average, have found it to be quite as "neare the marke" as either of them.

THE CHEMIST.

PHOTOGENY.

To the Editor of the Mechanic and Chemist.

SIR,—It is only till lately that my attention has been directed to your very interesting and useful little publication, others of a most aspiring, but less extensively-useful character, having obscured it from my view: now that I have seen and appreciated its merits, I am desirous of contributing, as much as I possibly can, to the object it appears to have in view, that of the diffusion of knowledge, and for that purpose I beg leave to forward you a few observations I have made on a subject which has lately much engaged the attention of the scientific world,

I mean that of photogenic, or solar drawing. I am the more induced to do so, from not having seen in the numerous papers that have at different times appeared on this subject, any decisive practical method of carrying out this very interesting discovery. I have myself been incessantly engaged in this study ever since its first appearance; and although I have not equalled the renowned Daguerre, nevertheless I think I may boast of having made some novel and useful observations, which may probably interest those of your readers who are yet engaged in this investigation. I shall begin by stating how I prepare my sensitive papari, and such as I have found, after numerous experiments, best to answer the purpose.

I first select a fine wove paper, which which has no water-mark, and as free from sizeing as possible; I then mark each sheet on one side with pencil, by drawing a line from corner to corner, to denote, when the paper is made, which side is *unprepared*; the next step is to sponge them over separately on both sides with a solution of chloride of soda (common salt), in the proportion of one dram of salt to eight ounces of warm water, taking care that the sponge has passed over every part. I them immerse them entirely in some of the same solution, and allow them to remain for at least two or three hours, and afterwards hang them on lines to dry, which, when accomplished, I sponge over on the unmarked side with a solution of the nitrate of silver, one dram to once ounce and a-half of distilled water; and great care must be taken to do this equally all over, otherwise blotches and imperfections in the paper will be the result. I have found a sponge, fitted into a wooden handle, presenting as wide a surface as possible, the best method of applying it when dry; this operation must be repeated a second time, and the whole process conducted in a chamber from which day-light is excluded. When the paper is quite dry it should be folded carefully up, and placed in a portfolio for use. These directions will be found to produce a good paper, and one that will keep a considerable time without changing colour, that is, becoming brownish, an objection to most of them.

A still more sensitive paper, but one that will change sooner, may be made by the ammoniacal nitrate, in the same proportions as the preceding, by adding strong liquor ammonia to the solution of silver, until it first precipitates the oxide, and then re-dissolves it. This solution is easily spread over the paper, and does not require any previous preparation; but it has the disadvantage, as I have before stated, of more rapidly becoming tinged, even if secluded from the light with the greatest care.

The best method of taking objects is by means of a frame, like a common drawing frame, furnished with a piece of plate glass, and a back-board between, on which I place folds of soft flannel, the whole kept in close contact by two cross-stays of wood. A simple machine of this kind is absolutely necessary, in order to insure a good impression, as the object you wish to take must be kept in the closest opposition with the paper, otherwise the picture will be imperfect.

I now come to that part of the process which, I doubt not, has proved most embarrassing to many, and in which very few have perhaps satisfactorily succeeded, that is the *fixing process;* this difficulty, I fear, has caused many to throw it up in disgust. I am happy, however, to be able to give you some instructions which will insure complete success.

As soon as possible after the drawings are taken, they should be immersed in cold water, in a high dish, or other convenient vessel, and left till the water becomes milky; throw this away, and add more, and repeat this operation several times, until the water ceases to change colour; they are then to be placed on clean sheets of paper, and well sponged over with the following solution, viz., one part of the liquid hyposulphite of soda to four of distilled water; leave them a few minutes for it to penetrate, and then plunge them again in cold water, and rince them as before, by fresh additions of water, until, on applying the tongue, no taste of sweetness can be detected; for as long as any of the hyposulphite of silver, which is intensely sweat, remains, they will be subject to change, but if treated in this manner they will be found to bear the most intense light without injury. I have had drawings done in this way in my possession for several months, and although I have exposed them to the continued action of the sun's rays, I cannot detect the least alteration.

The next fixing substance in value is the strong liquor ammonia; one dram to sixteen of water, with the necessary ablutions, as in the preceding; but I cannot recommend this with the same confidence as the other.

The most valuable property, however, of this paper, and one I believe which has

never yet been noticed, is that of changing from a dark colour to a very light one, by the continued action of the sun's rays; and I have made use of this quality for taking drawings in this manner, that is, by leaving the paper in the light to become quite dark, and afterwards taking whatever object I like in the usual manner, by exposing it again to the direct rays of the sun; in this way I have produced many drawings with the greatest accuracy, and with these important advantages, that the lights and shades are all correct, not reversed, as in the other case, and that they require scarcely any fixing, merely drawing them a few times through water being all that is necessary. It is true this process is much longer than the other, several hours of intense sunshine being necessary for the purpose; but you have the advantage of procuring an exact representation at once, and one that is easily preserved. The desideratum, therefore, is to find a method that shall cause the paper to turn as rapidly from dark to white as it does from white to dark; the only thing I have found as yet to facilitate this is by steeping the paper, previous to using it, in a weak solution of sulphurous acid, which I presume, acts by assisting the deoxidising properties of the sun's rays, and thus partially reducing the oxide of silver to its metallic state.

I mention this, hoping it may lead to farther investigation and improvement, being satisfied myself that we have hitherto been on a wrong scent, that we must now direct our attention to the discovery of a *dark substance*, easily acted upon by light, and not a white one as heretofore; and, indeed, I hesitate not to say, that should Daguerre's process ever be made known, it will be found to be something of this kind.

I remain, Sir,
Your obedient Servant,
W. H. HEWITT.

8, Store Street.

[The process of M. Daguerre not only produces a true representation of nature, with regard to light and shade, but the substance he has discovered is so amazingly sensible to the action of light, that an image in the camera obscura, imperceptible to the naked eye, is faithfully transferred to the design, and may be seen by the application of a magnifying glass. One important part of Daguerre's invention is the remarkable distinctness of the image delineated by his camera obscura. M. Biot compared the metallic surface which receives the impression in the Daguerrotype, to the retina of the eye; and such, indeed, is the perfection of the instrument, that it is little inferior to the living organ of vision, one of the most admirable works of nature! M. Daguerre having received his reward from the representatives of the French nation, is, doubtless, occupied in preparing a description of his process, and the numerous and interesting experiments which, after twenty years' labour, have led to the present brilliant triumph. Some of the early experiments of M. M. Daguerre and Niepce have been communicated to the French Academy, and were described in THE MECHANIC of the time. M. Daguerre recommends the paper to be dipped in muriatic ether, and carefully dried, before the application of the nitrate of silver; this paper is so extremely sensitive, that the radiation from a heated body is sufficient to discolour it, though the light be excluded; great caution must, therefore, be observed in drying and preserving it.—ED.]

GALVANISM.

1. GALVANISM is the term given to a species of electricity, developed by uniting two dissimular metals by an oxidating fluid. It is called galvanism, by having been discovered by Galvani, a professor of anatomy at Bologna.

2. He found that a dead frog skinned, is capable of having its muscles brought into action by means of electricity; and that, independent of any apparent electricity, the same motives may be produced in the dead animal, or even in a detached limb, by communications between the nerves and muscles with electrical conductors. The action of electricity on a dead frog, as well as other animals, occasions a tremulous motion of the muscles, as well as an extension of the limbs.

3. If the legs of a frog recently dead be skinned, and a small part of the spine be attached to them; and a part of the nerve proceeding from this limb be wrapped in tinfoil, or laid upon zinc, and a piece of silver laid with one end of the bare muscle, and the other on the tin or zinc, the motion of the limb will be very vigorous.

4. Similar experiments were now instituted on other animals with success; and as the power seemed to be inherent in the animal parts, those experiments, or the power which produces the motion of the muscle in those experiments, was called animal electricity. But it now being fully ascertained, that by the contact of metallic and other conducting substances elec-

tricity is generated, it is evident that the muscular motion in the above experiments is produced by metallic electricity.

5. It has been long asserted, that porter drank out of a pewter pot has a different taste than when drank out of a glass. Works of metal, whose parts are soldered together with other metals, are observed to tarnish about those parts where the different metals are joined; also the Etruscan inscriptions engraven on pure lead are preserved to this day, whereas, some medals of an alloy of lead or tin, of no very ancient date, are quite corroded. All these circumstances agree with the hypothesis, that the contact of different metals acted upon by an intermediate fluid, or the intervention of a metal between two different fluids, will produce the phenomena of galvanism.

6. The conductors of electricity may be divided into two classes, 1st. The perfect conductor, as the metals and charcoal, 2d. The imperfect conductors, as water, —the oxidating fluids, as the acids, or substances which contain these fluids.

7. The simplest combinations capable of exciting galvanic electricity, must consist of three different conductors; for two conductors only will not produce any sensible effect. Nor must the conductors be of one kind; and in order to make the combination active, it must consist of three different conductors, viz. one conductor of one class, and two different conductors of the other class.

8. When two of these bodies are of the first class, and one of the second, the combination is said to be of the first order; otherwise, it is said to be of the second order.

9. In a simple galvanic circle, as it is called, the two bodies of the same class must touch each other in one or more points; at the same time they are connected with each other at other points, by the third body of the other class.

10. The nerves of animals appear to be affected by smaller quantities of electricity than any other bodies with which we are acquainted.

11. The two metals may be placed either in contact with the preparation, or in any other part of the circuit; which may be completed by other conductors, as water, &c. Place two wine-glasses near each other, but not actually touching; put the prepared thigh and leg of a frog into the water of one glass, and laying the nerve over the edges of the two glasses, and let the tinfoil which is wrapped round it touch the water of the other glass. If you now form the communication between the water in the two glasses by means of silver; or put the fingers of one hand into the water of the glass that contains the leg, and holding a piece of silver, you touch the coating of the nerve with it, you will find that the prepared leg is so violently excited as sometimes actually to jump out of the glass.

12. This effect is by no means confined to dead animals, but can also be excited in the living; more especially the cold-blooded kind, as eels, flounders, &c. For instance, take a live flounder, dry it with a cloth, and put it in a pewter plate, or on a large piece of tinfoil, and place a piece of silver on its back; then with one end of a piece of metal, touch the pewter plate or tinfoil, and apply the other extremity to the piece of silver, and contractions will immediately ensue.

13. Both the senses of taste and sight are capable of being affected by it: let any person lay a piece of metal on his tongue, and a piece of some other metal under his tongue; in forming the connection between the two metals he will perceive a peculiar sensation, a kind of irritation accompanied with a cool subacid taste.

J. Mitchell.

METEOROLOGY.

Description of a Trombe, *or Whirlwind, in France.*

At a meeting of the French Academy of Science, on the 15th of the present month, M. Peltier communicated the result of his researches relating to the *trombe* which ravaged the commune of Chatenay, on the 18th of June. He examined the spot, in company with the proprietor of Chatenay Castle, collected the testimony of a multitude of persons who observed the phenomenon at different periods of its duration, and examined the traces which it had left.

In the early part of the day, a storm was formed to the south of Chatenay, and proceeded, about ten o'clock, towards the valley between the hills of Econen and Chatenay. The clouds were rather high, and after spreading as far as the village, they remained stationary, and the storm appeared about to resolve itself in a plain to the west, Chatenay being covered only by its eastern extremity. Thunder was heard, and the first storm presented no unusual phenomenon; but towards noon, a second storm came also from the south, advancing rapidly towards the same plain, and the same hill. Arrived at the extremity of the plain above Fontenay, and in presence of the first storm, which was situated at a

greater elevation than the second, its progress was for a time interrupted, leaving the spectators in doubt which direction the second storm would take. It was evident from their mutual repulsion, that the two clouds were charged with the same electricity, and the consequence, as might be expected, was a combat in which the earth took an important part.

Hitherto, thunder had been heard to proceed from the second storm, when suddenly one of the lower clouds descended towards the earth, and came in contact with it, and all explosion appeared to cease. A prodigious attraction took place ; all the light bodies, all the dust which covered the surface of the ground, rushed towards the point of the cloud ; a continual rumbling noise was heard ; small clouds were whirled about the inverted cone, ascending and descending rapidly. An intelligent observer, M. Dutour, being favourably placed, saw the cone terminated at the lower extremity, by a *calotte*, or cap of fire ; but a shepherd, Olivier, who was on the spot, saw nothing of the kind, owing to the torrent of dust in which he was enveloped. The trees situated at the S.E. of the trombe were partially attacked on the N.W. side ; those parts underwent a sudden and very remarkable alteration (which will be described hereafter), while the other portions of the same trees, preserved their sap and vegetation.

The trombe descended the valley at the extremity of Fontenay, following the direction of a row of trees, planted along the banks of the bed of a rivulet without running water, but wet at bottom ; then, after having broken and rooted up all it encountered, it crossed the valley, and advanced towards other plantations on the opposite hill, and destroyed them likewise. There it stopped several minutes, as if uncertain in which direction to proceed. It had arrived under the limits of the first storm, which had hitherto remained stationary, but now began to agitate itself, and retire towards the valley to the west of Chatenay. The trombe which remained upon the plain of Thibault, would infallibly have taken the direction of a wood to the westward, if the first storm had not prevented it by its repulsion. After having dried up, overturned, and destroyed all the plain of Thibault, the trombe advanced towards the park of Chatenay Castle, overturning everything it met with in its passage. Arrived in the park, it converted one of the most agreeable habitations in the environs of Paris, into a place of utter desolation. The park has lost all its old trees ; some young ones at the extremity, and beyond the action of the trombe, have alone escaped destruction. The walls are thrown down ; the mansion and the farm-house have lost their roofs and chimneys ; the trees were carried away several hundred metres ; fragments of wood and tiles from the buildings were projected to the distance of more than 500 metres. The trombe next descended the hill towards the north ; it remained some time over a pond, broke down and dried half the trees, and killed all the fish. It then proceeded slowly along an avenue of willows, whose roots were in the water ; during this passage it lost a great part of its extent and violence ; it continued to move still more slowly over an adjoining plain for about 100 metres, when it separated into two parts, one portion rising as a cloud, and the other dispersing itself on the ground. All the trees struck by the trombe, presented the same appearance ; all their sap was evaporated, the wood alone remaining, almost entirely deprived of its cohesion ; it was as dry as if it had remained 48 hours in an oven heated to 150^0 ; no vestige of humidity could be perceived. This immense quantity of vapour instantaneously formed, could only escape by bursting the tree ; and as the ligneous fibres are less cohesive in the horizontal than in the longitudinal direction, the trees were in some instances literally split into laths.

Fifteen hundred trees bear marks which prove that they have served as conductors to masses of electricity ; that the great elevation of temperature caused by the electrical flood, instantly vaporized all humidity in these vegetable conductors ; that this vaporization caused the trees to split longitudinally ; that the trees so dried and split became bad conductors, and would no longer afford a passage for the fluid ; and as they had lost their cohesive force, the violence of the trombe broke them, instead of tearing out their roots.

By following the progress of this phenomenon, we may observe the transformation of an ordinary storm into a trombe, which is designated whirlwind, or water-spout, according as it descends on the land, or on water ; and we are thus led to conclude, that the trombe is but a nebulous conductor, serving as a passage for the continual discharges from more elevated clouds. The only difference between an ordinary storm, and a storm accompanied with a trombe, is the addition of a conductor which directs the combat of a whole storm upon the points situated beneath the lower extremity of the cone.

Butterflies.—The Butterflies in foreign countries, are far more numerous, and much more remarkable for their size and beauty, than any in Britain. Lander, in his travels in Africa, says, "There was one beautiful sight which we cannot but mention,—an incredible number of butterflies fluttered about us like bees. They were variegated by the most brilliant tints. The wings of some were of shining green, edged and sprinkled with gold; others were of sky blue and silver; others of purple and gold, delightfully blending together; and the wings of some were like dark silk velvet, trimmed and braided with lace." On another occasion he says, "Millions of butterflies fluttered around us, and literally hid from our sight, every thing but their own variegated and beautiful wings."—*Juvenile Naturalist.*

Rain.—"The approach of the rainy season," says one who lived in India, "is generally announced by vast masses of clouds that rise from the Indian ocean, and advance towards the north-east, gathering and thickening as they come near the land. After some threatening days, the sky assumes a troubled appearance in the evening, and the monsoon generally sets in during the night. It is attended by thunder storms far exceeding those in more temperate regions. It generally begins with violent blasts of wind, which are succeeded by floods of rain. For some hours, lightning is seen almost without intermission; sometimes it only illuminates the sky, and shows the clouds near the horizon; at others, it discovers the distant hills, and again leaves all in darkness; when, in an instant, it re-appears, in vivid successive flashes, and exhibits the nearest objects in all the brightness of day. During all this time, thunder never cesses to roll; and is only silenced by some nearer peal, which bursts on the ear with such a sudden and tremendous crash, as can scarcely fail to strike the most insensible heart with awe. At length, the thunder ceases, and nothing is heard but the continued pouring of the rain, and the rushing of the rising streams. The next day presents a gloomy spectacle; the rain still descends in torrents, and scarcely allows a view of the blackened fields; the rivers are swollen and discoloured, and sweep down along with them the hedge, the huts, and the remains of the cultivation which was carried on during the last dry seasons in their beds."

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to eight ounces; then add one ounce of the black oxyde of manganese, reduced to an impalpable powder, and with it half an ounce of gum Arabic.

To Stain Paper.—"Publico, of Manchester," may stain paper a pink colour, by infusing an ounce of Brazil wood and half an ounce of pearl-ash in one pint of boiling water, and letting it infuse for two hours, then straining it, and apply it with a sponge. J. MITCHELL.

TO CORRESPONDENTS.

A. D. M.—*The method of preventing the dry rot by boring holes at the bottom of the trunk, to kill and drain the tree before it is felled, was described in a recent number of the "Mechanic." We shall be glad to receive the papers on optical instruments.*

N. P. R. *will find an article in our present number, which will answer his query; but the mode of silvering copper there described, is not well suited to articles exposed to handling, as it will soon wear off. There is no process of silvering at present known, which will deposit a coat of silver of any considerable thickness, except by tedious and difficult operations, which are only applicable to particular cases.*

W. G. A. H.—*The subject of his communication respecting the Leyden phial, was ably described in a recent number of the "Mechanic," by our talented correspondent "Electron."*

Experimentalist.—*Faded flowers may be restored by inserting the stalks in boiling water.*

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THE

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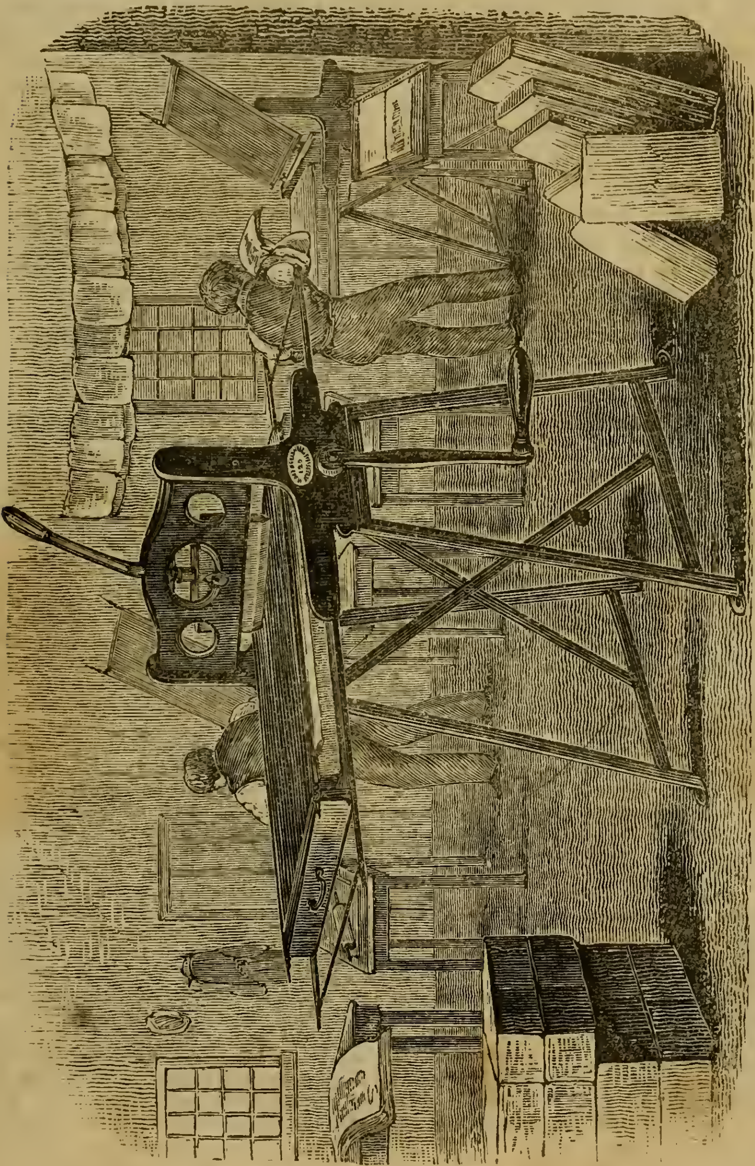

THE LITHOGRAPHIC PRESS.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

WOOD AND SHARWOOD'S LITHOGRAPHIC PRESS.

To the Editor of the Mechanic and Chemist.

Sir,—As you were pleased, on a former occasion, to notice the Columbian Press of our manufacture, we beg now to furnish you with a sketch of a lithographic press, which we have lately introduced to the trade, a notice of which will oblige,

Yours, respectfully,

Wood and Sharwood.

120, Aldersgate-street.

[The only difference we discover in these presses from those originally manufactured, is in the stands being made of iron, instead of wood, which is decidedly an improvement.—Ed.]

AMERICAN LOCOMOTIVES.

A short time back, we published an article on this subject, in which it was stated, on the authority of the *Mining Journal*, that the directors of the Birmingham and Gloucester Railway had contracted with an American manufacturer for the supply of engines; the truth of that statement, we are sorry to find, is fully confirmed by a communication from the engineer, captain Moorson, to the "Railway Times" of last Saturday. We insert that letter, as it is intended for a defence; but we cannot help remarking that it is *very strange indeed* that America should so suddenly have surpassed England in the manufacture of machinery, for which this country has hitherto been so pre-eminent. The "Railway Times" appears perfectly satisfied with the explanation; and we are sorry that we cannot join our contemporary in excusing the transaction. If the legislature were to interfere to prevent the importation of foreign engines, the directors of the Birmingham and Gloucester Railway Company (the only one in England which cannot procure suitable engines in this country), would, no doubt, soon recollect the address of some manufacturers who could supply them. Captain Moorson's letter is as follows:—

"Sir,—I have observed in your journal of the 20th instant, an article extracted from the *Mining Journal*, headed, "Encouragement to Engineers," which seems in some degree to reflect upon the Directors of the Birmingham and Gloucester Railway, in consequence of their having given a "conditional order" for some American engines. As I have borne a principal share in the recommendation by which the Directors have come to their own conclusion on the occasion referred to, you will excuse my taking this means to inform the *Mining Journal*, that the question of making locomotive engines of the kind which led to the "conditional order," was discussed with two makers of celebrity in this country in the first instance, and it was not until they had declined to undertake an order that a negociation was set on foot with an American engineer. The *Mining Journal* appears to give credit to the Directors for having obtained a good article, but appears to be dissatisfied with the further course pursued by those gentlemen, viz., to procure duplicates of the same good article under like conditions; and in preference, it advises that the Directors should endeavour to procure uncertain imitations of the article. Under the above explanation, I hope it will appear that the course pursued was neither so improper nor so injudicious as the writer of the article in question would seem to imply.

I am. Sir, yours faithfully,

W. S. Moorsom, Engineer.

Worcester, 26th July, 1839.

ADAMS'S PATENT CARRIAGE SPRINGS.

It has been affirmed that Mr. Adams's bow-springs do not offer the same security from accident as those constructed on the old plan; the following is Mr. Adams's own vindication of the principle of his patent bow-springs:—

"Having been given to understand that an opinion, or rather notion, is rife amongst many persons connected with railroads, that the safety of the patent bow-springs in use on the London and Birmingham line, is not commensurate with their acknowledged ease of motion, I ask the favour of a short place in your columns, to show the fallacy of such a notion, and the source from whence it has arisen.

The spring in common use acts merely as a cushion between the body and axle, its motion is very small, and it provides only for vertical shocks. It has no attachment to the vehicle, and consequently grooved guards are provided, firmly bolted to the frame-work, and in which the axle box slides up and down, much as an oar is retained by the thole pins of a boat. If the spring were to break, the axle would still retain its position of traction.

In the patent bow-spring, the axle guards are dispensed with, and therefore unscientific persons deem that the security is lessened. But mechanicians who examine carefully will find, that the security

of the spring is wholly independent of its elastic properties. Were the spring bows wholly removed, the axles would be retained in their proper position as regards traction, by the tension of the iron braces or links employed to suspend the locomotive engines on their springs. In fact, were the springs to break, the links would have the greater portion of their strain removed, and the vehicle would rest on the axle boxes. Inasmuch as the strain of the patent spring links is in a direct line, and that of the axle guards is at a right angle, by so much must the links be stronger than the guards. No mechanician will attempt to refute this position. The iron used in the common axle-guards is not mechanically disposed to produce the greatest effect with the smallest consumption of material."

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 299.)

On the following year he was brought to England as before stated; it was attempted to instruct him, but he was found to be in a state of complete imbecility, being unable even to articulate more than a few words. His education was therefore abandoned, and an annual sum of thirty-five pounds was allowed for his support at a farm-house kept by a person named Fenn. Notwithstanding this liberal pension, he was required to perform labour for which his imbecility rendered him unfit, and sometimes incapable; he could not be trusted to do any work without constant superintendence, and it is said that even whipping was resorted to when he refused to work. Sometimes, when he was set to load a dung-cart, he would proceed till he had accomplished his task, and then deliberately unload it again, thus showing the utter imbecility of his mind.

He manifested no partiality for the fair sex, unless they were gaily dressed; and he would contemplate with equal admiration the gilt buttons of a coat, and testify his admiration by clapping his hands. He was exceedingly fond of strong drink, especially gin, which he swallowed with great eagerness when it was occasionally offered to him, and he expressed his delight in his usual way by clapping his hands. Upon one occasion he wandered into Norfolk, and was apprehended as a spy of the Pretender; his unshaved beard and singular appearance, combined with his inability to speak, created a suspicion that he was a foreigner, and he would probably have been hardly dealt with, had he not been described in an advertisement in "The Hue and Cry," which fortunately led to his being discovered, and restored to his keepers. Among the few words he was able to utter, was the answer to a question frequently put to him, "who was his father?" to which he invariably answered, "King George." He would walk unceremoniously into any house or apartment to which he could gain access, without appearing to be in the least aware of his indiscretion. He lived in the reigns George I., George II., and George III. He was taken to court a short time before he died, by order of George III. Sometime after his death, an application was made for his body, by a person who stated that he had journeyed from Hanover for the purpose of obtaining it; the minister would not, however, consent to its removal, though large sums were offered for it.

Ashridge Abbey, the property of the Bridgewater family, is situated a short distance northward from Berkhamstead; it is a magnificent Gothic structure, surrounded by a delightful park, five miles in circumference. The mansion cannot be seen from the railroad.

From Berkhamstead, the line proceeds on a rising plane to the Dudswell excavation, which is in some places 50 feet deep, and through the Northchurch tunnel, 360 yards in length, to

Tring Station and summit, distant from London 31½ miles, from Birmingham 80½ miles. On entering Tring from the station, the mansion belonging to Mr. Kay, is discovered through a broad avenue of noble trees. This mansion is remarkable for having been the residence of Nell Gwynne, the celebrated favourite of Charles II. Nell was a general favourite; a great beauty, possessing a lively disposition, and, above all, an excellent heart, which endeared her even to those who could not be blind to, or sanction her faults. Although her youth was passed amidst scenes of dissipation and vice, and deprived of the advantages of education, her natural talents, vivacity, and ready wit, gave her a constant advantage over her more refined and cultivated rivals. She first attracted the king's notice at the theatre, while delivering an address with a hat of enormous dimensions on her head. The king took her to his palace to supper with him, and from that day she never forfeited her place in the affection of her royal protector. The king often found consolation in her society, which the vulgar sycophants of the court could not supply. Upon one occasion he entered her

apartment, "bourn down with the cares of state," and asked her what he could do to satisfy the people? Nell immediately replied, that he had only to dismiss his ladies and attend to his business. Frankness and disinterestedness are always pleasing; but they must be peculiarly so to a king, who so seldom meets with them. The following sketch is from *Campbell's Life of Mrs. Siddons.*

"Among Charles's mistresses, his 'Loves of the Theatre' were the least expensive and unpopular. Nell Gwynne, it is true, had 1500*l.* a year; but the Duchess of Cleveland had 4700*l.*; the Duchess of Portsmouth had still more. The latter was hated by the whole nation, while Nelly, who was called the 'poor man's friend,' was literally a general favourite, and not undeservedly; for, bred as she had been, as an orange girl, amidst the haunts of dissipation, vice was more her destiny than her blame. She was really a good-hearted woman, and, in the days of her prospity, showed herself grateful to her old friends; among whom she had the honour of ranking Otway and Dryden. She was faithful to the king, never pestered him about politics, and was never the creature of ministers. Once when Charles had ordered an extravagant service of plate, as a present to the Duchess of Portsmouth, from a jeweller in Cheapside, an immense crowd collected about the shop, cursing the Duchess, and wishing that the plate were melted, and poured down her throat. But they added, 'What a pity it should not be bestowed on Madame Ellen!' Nell was often successful in throwing ridicule on her rival, the Duchess of Portsmouth, originally Madamoiselle Querouaille. She pretended to be related to the best families of France, and whenever one of their members died, she put herself into mourning. It happened that news of the Cham of Tartary's death had lately reached England. A prince of France was also recently dead, and the Duchess of Portsmouth was of course in sables. Nell came to court in the same attire, and standing close by her grace, was asked by one of her friends, why she was in mourning? "Oh," said Nell, "have you not heard of my loss in the death of the Cham of Tartary?" "And what the deuce," replied her friend, "was the Cham of Tartary to you?" "Oh," answered Nell, "exactly the same relation that the Prince of —— was to Mlle. Querouailie.'"

The present mansion was built by Sir Christopher Wren; it is situated in a pleasant park, with woody hills rising in the back ground. At the back of the chief inn, the Rose and Crown, is an eminence called Stubbings's Wood, from which an extensive view is obtained of the surrounding country; amongst the most conspicuous objects are seen the reservoirs of the Grand Junction Canal, the hill of Ivinghoe, the column at Aldbury, erected by the Countess of Bridgewater, Leighton Buzzard church, and the line of the railroad, winding through the chalky soil, subduing mountains and valleys to one even line—a stupendous work, destined to remain, if human foresight may predict, till some revolution, great as the deluge, shall once more overwhelm the face of nature with desolation and confusion. The town, which is also seen from this point, surrounded with a forest of various kinds of trees, was a place of great note before the Norman Conquest: it was called by the Saxons "*Treung;*" but it is the opinion of some antiquarians, that it is of Roman origin, and that its name is derived from its triangular form. The Roman way, called Iknield-street, which extended from Yarmouth in Norfolk, to Barley in Hertfordshire, passes near this town; and Roman relics have, at different periods, been found in its neighbourhood. A market is held on Friday, chiefly for the sale of corn, meat, and straw plat. The church is an extensive building, dedicated to St. Peter and St. Paul; it consists of a nave, aisles, and chancel, with a massive tower at the west end. The nave is separated from the aisles by six Gothic arches, rising from high clustered columns.

(To be continued.)

THE CHEMIST.

GALVANISM.

(*Continued from page* 309.)

14. In order to affect the sense of sight by the means of galvanic electricity, let a person in the dark place a piece of zinc between the upper lips and the gums as high up as possible, and a piece of silver upon the tongue, and whenever the two metals are made to communicate either by the immediate contact of their edges, or by the interposition of any good conductor, a flash of light is perceived.

15. The most powerful galvanic combinations of the second order, are where two conductors of the second class have different chemical actions in the conductors of the first class, at the same time that they act upon each other. Thus copper and zinc, with a solution of an alkaline sulphate and diluted nitric acid, form a very active galvanic circle.

16. The following table of galvanic arrangements were drawn up by Sir Humphrey Davy, late professor of chemistry at the Royal Institution.

17. Table of galvanic circles of the first order, composed of two perfect conductors, and one imperfect conductor.

Very Oxydable Substances.	Less Oxydable Substances.	Oxydating Fluids.
Zinc	With gold, charcoal, silver, copper, tin, iron, mercury.	Solutions of nitric acid in water of muriatic and sulphuric acids, &c. Water holding in solution oxygen, atmospheric air, &c.
Iron	With gold, charcoal, silver, copper, tin.	
Tin	With gold, silver, charcoal.	
Lead	With gold, silver.	
Copper	With gold, silver.	Solution of nitrate of silver and mercury, nitric, and acetous acid.
Silver	With gold.	

18. Table of galvanic circles of the second order, composed of two imperfect conductors and one perfect conductor.

Perfect Conductors.	Imperfect Conductors.	Imperfect Conductors.
Charcoal ...... Copper .... Silver .... Lead .... Tin .... Iron .... Zinc	Solutions of hydrogureted alkaline sulphurets capable of acting on the first three metals, but not on the last.	Solutions of nitrous acid, chlorine, &c., capable of acting on all the metals.

19. Since Galvani's discoveries, the action arising from the combination of three conductors, has been examined with great care and considerable success, by Professor Volta, who discovered that by repeating the combinations, the power of the circles, or batteries, as they are now called, is prodigiously increased ; for instance, if the combination of copper, zinc, and water, produce a certain effect, a second combination (viz., another portion of copper, zinc, and water) added to the first, increases the effect, and so on.

20. The repeated combinations are now called indiscriminately, Galvanic or Voltaic piles or batteries. These batteries are said to be of the first or second order, according as the simple combinations of which they consist are of the first or second order. Thus, if a piece of zinc be laid upon a piece of copper, and a piece of moistened card be laid upon the zinc, then a similar arrangement of three other pieces be laid upon them, and a third arrangement be laid upon that, the whole will form a battery of the first order. But if the arrangement be made by connecting a piece of copper with a piece of cloth, moistened with a solution of sulphuret of potash, and this again with another piece of copper, the whole will form a battery of the second order.

21. Care must be taken in arranging the plates of a galvanic battery, that the parts do not counteract each other. The mode of accomplishing this will be the more readily understood, when it is considered that every galvanic combination has a positive and negative end, or pole, as it is termed, or that the electric fluid circulates only one way.

22. These batteries may be constructed in an infinite number of forms; I shall here describe those which have been most generally used.

23. The apparatus of Volta was constructed in the following manner :—Take a number of plates of copper, and a like number of zinc, and half the number of pieces of woollen cloth and of card ; let the last be soaked in any of the following solutions—sal ammoniac or even common water. A pile is to be formed of these substances in the following manner:--A piece of zinc being first laid down, is to be covered with a piece of copper, not the copper by one of the pieces of moistened woollen or card ; the same order is to be observed throughout, viz., zinc, copper, woollen, until the whole are disposed of, taking care, that in no instance is the order reversed ; we shall then have the top of the pile terminating in copper, and the lower end in zinc ; to each of which are attached a wire, forming the poles, as they were termed, but are now called by Professor Faraday, the *electroites*.

24. This instrument is then fit for use ;

but as the pieces, when unsupported, are apt to fall down when their number is considerable, it is best to support them by three rods of glass, and touching the metallic pieces at three equally distant points. Down these rods may slide a circular piece of wood, having three holes in it, which will serve to keep the different pieces in close contact.

J. MITCHELL.

(To be continued.)

AN AMERICAN CEDAR SWAMP.

THESE swamps are from half a mile to a mile in breadth, and sometimes five or six in length, and appear as if they occupied the former channel of some choked-up river, stream, lake, or arm of the sea. The appearance they present to a stranger is singular. A forest of tall and perfectly straight trunks, rising to the height of 50 or 60 feet without a limb, and crowded in every direction, their tops so woven together as to shut out the day, spreading the gloom of a perpetual twilight below. On a nearer approach, they are found to rise out of the water, which, from the impregnation of fallen leaves and roots of the cedars, is of the colour of brandy. Amidst this bottom of congregated springs, the ruins of the former forest lie in every state of confusion. The roots, prostrate logs, and in many places the water, are covered with green mantling moss; while an undergrowth of laurel, fifteen or twenty feet high, intersects every spring so completely, as to render a passage through laborious and harassing beyond description; at every step, you either sink to the knees, clamber over fallen timber, squeeze yourself between the stubborn laurels, or plunge to the middle in ponds made by the uprooting of large trees, and which the green moss concealed from observation. In calm weather, the silence of death reigns in these dreary regions; a few interrupted rays of light shoot across the gloom; and unless for the occasional hollow screams of the herons, and the melancholy chirping of one or two small birds, all is silence, solitude, and desolation. When a breeze rises, at first it sighs mournfully through the tops; but as the gale increases, the tall mast-like cedars wave like fishing poles, and rubbing against each other, produce a variety of singular noises, that, with the help of a a little imagination, resembles shrieks, groans, growling of bears, wolves, and such like comfortable music.—*Wilson's American Ornithology.*

SOLUTION OF PROBLEM.

To the Editor of the Mechanic and Chemist.

SIR,—I send you a solution of the equation proposed by H. Bowler, in No. 25, New Series.

Given $\sqrt[3]{a+\sqrt{x}}+\sqrt[3]{a-\sqrt{x}}=\sqrt[3]{b}$, find x cube each side;

$$a+\sqrt{x}+a-\sqrt{x}+3\sqrt[3]{a^2-x}\left\{\sqrt[3]{a+\sqrt{x}}+\sqrt[3]{a-\sqrt{x}}\right\}=b.$$

Adding, substituting, and transposing, we get

$$3\sqrt[3]{a^2-x}\sqrt[3]{b}=b-2a$$

$$27(a^2-x)b=b^3-6b^2a+12ba^2-8a^3$$

$$27bx=8a^3-15ba^2+6b^2a-b^3$$

$$x=\frac{8a^3-15a^2b+6ab^2-b^3}{27.b}$$

Which is the answer required.

G. H. ROLL[illegible].

Knowledge is Power.—At a meeting which took place the other evening for the purpose of forming a North London Mechanics' Institution, Mr. Basil Montagu, as an illustration of the maxim that "knowledge is power," related the following anecdote:—He was walking a few months ago in Portland-place, when he observed a large crowd of people assembled, and found that it was in consequence of a large mastiff dog having a lesser one in his gripe. Several persons tried, by splitting the mastiff's ear, and biting and pinching his tail, to make him let go his hold, but in vain. At last a delicate genteely-dressed young man came up, and making his way through the crowd into the circle, requested to be allowed to separate the dogs; assent was given amidst jeers and laughter, when he deliberately drew from his pocket a large snuff-box, and having taken a pinch himself, inserted his fingers again into the box, and withdrawing a larger pinch, applied it to the mastiff's nose. The snuff operated so powerfully on the animal's olfactory nerves, that he not only immediately let go his hold, but made his escape as fast as he could.

The young man was loudly cheered, upon which he stopped for a moment, and said, "Gentlemen, I have merely given you a proof that knowledge is power."

Expeditious Transit by the Railway.—The corps of riflemen, sent from Birmingham to Coventry on Monday se'nnight, in consequence of the Chartist meeting to be held there, were conveyed by the railway, a distance of more than nineteen miles, in the astonishingly short space of nineteen minutes and a half.—*Northampton Mercury.*—A gentlemen left Liverpool, on Tuesday, by the half-past ten train, for Birmingham, where he arrived in time to join the mail train, which started for Liverpool at ten minutes before three o'clock, and reached the station, in Lime-street, at ten minutes before seven, thus accomplishing the journey, up and down, 195 miles, by the regular trains, in eight hours and twenty minutes.—*Liverpool Mercury.*

The "Bottomless Meadow."—We have ascertained that the account which we published in our last number from the "Glasgow Courier," of a sinking meadow on the line of the Glasgow and Ayrshire Railway, is itself without foundation; we are requested to state, and we take pleasure in doing so, that no such impediment has been encountered on the Glasgow, Paisley, and Ayr Railway. If the difficulty had really occurred, the mode of proceeding would have been very different from that described by the "Northern Light:" the cause would first have been ascertained by boring, and a remedy applied accordingly.

Penny Postage in New South Wales.—Mr. Raymond, the Post-master-general at Sydney, has prevailed upon Sir George Gipps, to permit him to add to the accommodation of the people of that large town, by selling stamped envelopes of one penny each, which will cover one ounce, conveyed post free through the range of the before two-penny post.—*Austral. Asiatic Review, Jan.* 1.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, August 16, J. C. Bowles, Esq., on Lithography. At half-past eight.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Aug. 15, W. H. Stoker, Esq., on the National Melodies of Ireland. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, August 13, Dr. John Walker, on the Diseases of, and Operations on, the Eye. At a quarter to nine.

QUERIES.

A good receipt for making a varnish generally used for maps, prints, &c.? Also, if there is any work extant which treats of varnish and colour-making generally, and if so, what the title is, and where to be obtained?

QUEVED.

[Gum copal, dissolved in spirits of wine, will make the best varnish that can be procured. The paper must be well sized before the varnish is applied, or the engraving will be irrecoverably spoiled. This varnish may be written on with a pen and ink, and no trace will remain when it is washed. Gum mastic is cheaper and more easily dissolved, but it is not so hard.—ED.]

How to make *squeezing wax*, such as is used by carvers; and also how to make a composition that will possess the following qualities:—forming a body, will retain from wood, remain soft and pliable, and will allow of an impression being taken with the fingers without the use of oil? Also, if there are any means by which cast steel and wrought iron can be joined without soldering?

[Wrought iron and steel can be joined together by welding, as is done in table knives, and in most cutting instruments.]

I should feel obliged if you or any of your correspondents will inform me how it is that the admixture of alcohol with water is attended with the evolution of heat? I can account for the same results accruing from the combination of sulphuric acid with water, but cannot comprehend how, by adding a fluid, the specific gravity of which is less than water, should produce a fluid denser, and, I suppose, of greater specific gravity than the water. C. H.

City-road.

[Density and specific gravity are identical; the evolution of heat, when alcohol enters into combination with water, is a phenomenon which chemistry has not yet explained; for the present, we refer our correspondent to a recent article in the "Mechanic" on chemical forces; and we shall be able to give him the opinion of M. Gay Lussac on the subject in a short time.—ED.]

What would prevent steel pens from rusting when ink is used? EXPERIMENTALIST.

ANSWER TO QUERY.

To Silver Brass.—"Tyro." Take of tartar, two drachms; common salt, two drachms; alum, half an ounce; and mix with fifteen or twenty grains of silver precipitated from nitric acid by copper. The surface of copper or brass becomes white when rubbed with this powder, which may afterwards be brushed off and polished with leather.

Another Method.—Half an ounce of silver that has been precipitated from aqua fortis by copper, common salt, and sal ammoniac, of each two ounces; corrosive sublimate, one drachm, are triturated together, and made into a paste with water; with this, copper utensils of any kind that have been previously boiled with tartar and alum, are rubbed, after which they are made red hot and polished. C. H.

To remove Superfluous Hair.—Quick lime, twelve ounces; starch, ten ounces; white sulphur of arsenic, one ounce. These being well pounded and mixed, must be put into boxes. To use this powder, it is made into a paste with some water, or the white of an egg, and then rubbed on the part where the superfluous hair may be. When dry, it is washed off with warm water, and the hair comes off at the same time.

W. G. A. H.

To Stain Wood.—The wood must be done over twice with a hot solution of log-wood; some iron filings are then to be put into a bottle with some vinegar and some copperas, and left to stand a day or two, when the wood is to be done over evenly with it, and afterwards polished with heel ball, that which shoemakers use.

N. P. R.

To make Chlorate of Potass.—Into a stoppered glass retort put eight parts, say ounces of common salt; three of black oxide of manganese; pour on four ounces of concentrated sulphuric acid, previously diluted and allowed to cool; after mixing with four ounces of water, immerse the neck of the receiver in a solution of caustic potash; apply the flame of a spirit lamp to the retort. Let the solution be perfectly saturated with the gas. Remove and gently evaporate the first crystals, which form the salt required. Care should be taken not to let the gas escape into the apartment. For further details, see "Faraday's Manipulations."

Curious Experiment.—"D. J." For the explanation of this phenomenon, a gold medal and one hundred guineas were offered some years since by the Royal Society. Such explanation has been given by Dr. Robert Hare, of the United States of America, and is as follows:—

"Supposing the diameter of the discs of card to be to that of the hole as 8 to 1, the area of the former to the latter must be as 64 to 1. Hence, if the discs were to be separated (their surfaces remaining parallel) with a velocity as great as that of the air-blast, a column of air must meanwhile be interposed sixty-four times greater than that which would escape from the tube during the interim; consequently, if all the air necessary to preserve the balance be supplied from the tube, the discs must be separated with a velocity as much less than that of the blast, as the column required between them is greater than that yielded by the tube, and yet the air cannot be supplied from any other source, unless a deficit of pressure be created between the discs, unfavourable to their separation. It follows, then, that under the circumstances in question, the discs cannot be made to move asunder with a velocity greater than one-sixty-fourth of that of the blast. Of course, all the force of the current of air through the tube will be expended on the moveable disc, and the thin ring of air which exists around the orifice between the discs, and since the moveable disc can only move with one-sixty-fourth of the velocity of the blast, the ring of air in the interstice must experience nearly all the force of the jet, and must be driven outwards, the blast following it in various currents, radiating from the common centre of the tube and discs."

T. J. B.

[That this singular phenomenon will ultimately be explained, there can exist but little doubt; but hitherto the researches of philosophers have thrown no light whatever on the subject. We shall be glad to insert any other plausible attempt, although, like the present, it may be inadequate to the purpose of explanation. We will return to this subject shortly.—Ed.]

TO CORRESPONDENTS.

J. M. C.—*Boiling water, when it can be applied, is certain destruction to the annoying insects and their eggs; a stream of hot steam from boiling water projected into the holes in which they breed, has in some cases succeeded; turpentine will destroy them, but its odour is very unpleasant; mercury formed into an ointment as sold at the chemists, is a permanent remedy; as it not only kills them when applied, but will prevent their return to the same place, so long as any of the substance remains. Its action is not diminished by long exposure.*

X. Y.—*One pound of parchment or vellum shavings must be put into a gallon of water, and boiled until the water becomes a perfect size. It is then to be strained through a fine cloth, on which must be strewed a small quantity of white vitriol and roach alum finely powdered. While the size is hot, the paper must be dipped into it, and immediately removed. It should be dried by hanging on a line where the direct rays of the sun do not come near it.*

A Constant Purchaser *will find the information he requires in some of our past numbers; we will, however, refer to those articles, and supply the deficiency next week, if the subject is not sufficiently explained.*

S. R.—*The penny postage will certainly come into operation very shortly. It is the opinion of the Post-office authorities, that a trial may be made by the* 10*th of October.*

Answers to J. B. and P. T., *shall appear in our next.*

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MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XLI. NEW SERIES. | SATURDAY, AUG. 17, 1839. PRICE ONE PENNY. | No. CLXII. OLD SERIES.

Fig. 1.—FRONT WINDOW OF WESTMINSTER HALL.

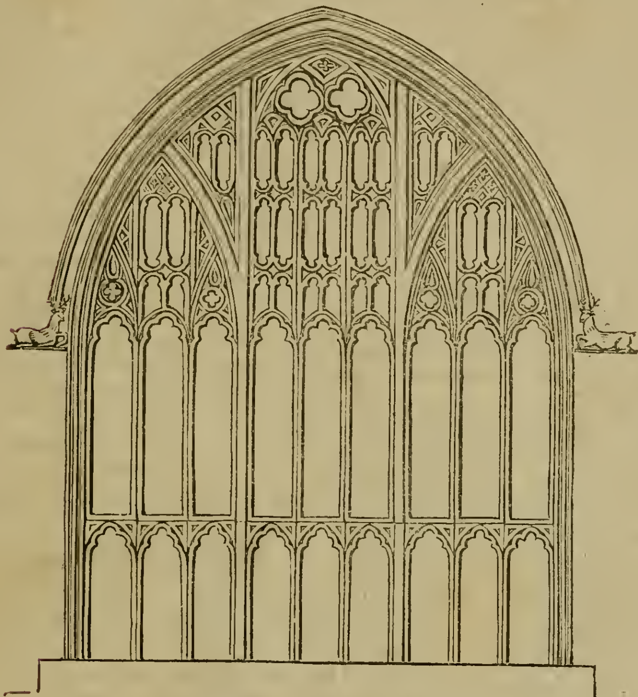

Fig. 2.—DOOR-WAY OF WESTMINSTER HALL.

City Press, 1, Long [illegible]e, Aldersgate Street: D A Doudney.

HISTORY OF ARCHITECTURE.

NO. VI.

(Continued from page 290.)

(See engraving, front page.)

The Florid, or Perpendicular Style.—This, the third division of Gothic architecture, was styled "florid," because of the vast profusion of ornament used in it. The term "perpendicular" arose from the fact, that the lines of division run straight up, without any recesses, from bottom to top. This is a distinguishing point between it and the other styles. The windows are more expanded, and are enriched with the most gorgeous tracery. Its variety, however is not very great, for, as the mullions (vertical bars made use of to divide the windows into breadths) run perpendicularly up into the head, which is another decisive characteristic of the style; they do not allow of it. The heights of these windows are broken by transoms (horizontal bars, or cross-mullions), which are adorned above, sometimes with battlements, and the under sides generally have feathered arches.

In the doors, also, there is a decided difference. The arch of the door-way is generally inclosed by a label, which is an horizontal moulding at the top of the arch, and continues at right angles on both sides down to the springing line. The angles thus made are usually filled up with some circular ornament. The *pinnacles* and *buttresses* are distinguished from the last mostly by their richness. The *steeples* are highly adorned, and *lantern turrets* are generally used in lieu of spires.

A good specimen of the *florid style*, and one which the reader may examine for himself, is Westminster Hall (near the Abbey). This building exemplifies most of the peculiarities of this style.

We will, as with the *decorated style*,* illustrate the *florid* by drawings of a window and door-way in it. Fig. 1 is the front window of Westminster Hall above mentioned. In it will be observed the upright mullions running straight up into the arch, and the cross mullions with their ornaments.

Fig. 2 is the door-way of the same building. It is deeply recessed, and the reader will see the "label" before spoken of.

The florid style was in constant use until the reign of Henry the Eighth; after his reign, Italian work was invariably mingled with it. This mixture of Gothic and Italian was designated "the Elizabethian style," and was used until the reign of James the First. The person who first executed the Italian style of architecture in England, was the celebrated Inigo Jones. This great man was born about the year 1572. For the study of painting he went to Venice, and there became excessively fond of architectural science; so, leaving his former pursuit, he carefully studied Palladio. He held the post of first architect to Christian the Fourth, king of Denmark. Jones arrived in England during the reign of James the First, and obtained the appointment of architect to some members of the royal family. On the death of the Prince of Wales (to whom he was architect), he again went to Italy, and returned when the office of surveyor-general was vacant, to take it. So well did he acquire the style of Palladio, that he received the appellation of "*the English Palladio.*" He died, aged near ninety years, about 1652. He altered the old cathedral of St. Paul's, which was in the pointed style, and affixed an Italian front to it. The church also of St. Paul, Covent-garden, is the work of this architect.

PROPORTIO.

* In my last, I omitted to state, that the first example of the decorated, is a window from Sustead Church.

DRAINING OF LAND BY STEAM.

THE drainage of land by steam power has been extensively adopted in the fens of Lincolnshire, Cambridgeshire, and Bedfordshire, and with immense advantage. A steam-engine of ten-horse power has been found sufficient to drain a district comprising 1000 acres of land, and the water can always be kept down to any given distance below the plants. If rain fall in excess, the water is thrown off by the engine; if the weather is dry, the sluices can be opened, and water let in from the river. The engines are required to work four months of the twelve, at intervals, varying with the season; where the districts are large, the expense of drainage by steam power is about 2*s.* 6*d.* per acre. The first cost of the work varies with the different nature of the substrata, but generally it amounts to 20*s.* per acre for the machinery and buildings. An engine of forty-horse power, and scoop-wheel for draining, and requisite buildings, costs about 4000*l.*, and is capable of draining about 4000 acres of land. In many places in the fens, land has been purchased at from 10*l.* to 20*l.* per acre, which has been so much improved by drainage, as to be worth 60*l.* to 70*l.* per acre. The following list shows the num-

ber of steam-engines employed for this purpose in England. Deeping Fen, near Spalding, Lincolnshire, containing 25,000 acres, is drained by two engines of 80 and 60-horse power. March West Fen, in Cambridgeshire, containing 3600 acres, by one engine of 40-horse power. Misserton Moss, with Everton and Graingeley Carrs, containing about 6000 acres, effectually drained by one engine of 40-horse power. Littleport Fen, near Ely, about 28,000 acres, drained by two steam-engines of 30 or 40-horse power each. Before steam was used, there were 75 wind-engines in this district, a few of which are still retained. Middle Fen, near Soham, Cambridgeshire, about 7000 acres, drained by an engine of 60-horse power. Waterbeach Eevel, between Ely and Cambridgeshire, containing 5000 acres, by a steam-engine of 60-horse power. Magdalen Fen, near Lynn, in Norfolk, contains upwards of 4000 acres, and is completely drained by a steam-engine of 40-horse power. March Fen district, Cambridge, of 2700 acres, is kept in the finest possible state of drainage by a 30-horse power engine. Feltwell Fen, near Brandon, 2400 acres, by an engine of 20-horse power. Soham Mere, Cambridgeshire, formerly (as its name implies) a lake of 1600 acres, drained by a 40-horse power engine, the lift at this place being very great.

NATURAL HISTORY.

MIGRATION OF BIRDS.

It is a remarkable and curious fact, that all the researches of naturalists for centuries past, have not led to the discovery of the place of retreat of the swallows and some other birds, which disappear at the approach of winter. The prevailing opinion is, that they migrate into warmer climates in the south; and there are circumstances which seem to corroborate that opinion, if they do not absolutely establish its truth. About the middle of October, great numbers of swallows are commonly seen congregated about a tree, a bush, or sometimes on the tower of a church or other building, where they are observed to remain hovering about, and occasionally making an experimental trip, till at last they rise in a flock to a great height, and take their final departure for the season, and it is a rare occurrence to meet with a single stray swallow after this flight. It has also been affirmed by navigators, that large flights of these birds have been met on the Atlantic at the season of emigration, nearly midway between Europe and America; it is, however, a very remarkable circumstance, if they do really emigrate, that their presence should not be perceived in the countries they choose for their winter abode. Most ancient writers agree in the opinion, that swallows do not emigrate to any very distant place, but conceal themselves in holes, in sand, or even under water. A gentleman from Bedford, in whose veracity we have the utmost confidence, assures us that he has actually seen considerable numbers of swallows plunge into the shallow water and bury themselves in the mud in a fen near that town, and that he has taken them out after a time, in a dormant state, and restored them by warmth. The following was communicated to the Royal Society by Mr. Achard:—

"In the latter end of March, I took my passage down the Rhine, to Rotterdam. A little below Basil, the south bank of the river was very high and steep, of a sandy soil, sixty or eighty feet above the water.

"I was surprised at seeing, near the top of the cliff, some boys tied to ropes, hanging down, doing something. The singularity of these adventurous boys, and the business they so daringly attempted, made us stop our navigation, to inquire into the meaning of it. The watermen told us, they were searching the holes in the cliffs for swallows, or martins, which took refuge in them, and remained there all all the winter, until warm weather, and then they came abroad.

"The boys being let down by their comrades to the holes, put in a long rammer, with a screw at the end, such as is used to unload guns, and, twisting it about, drew out the birds. For a trifle I procured some of them. When I first had them, they seemed stiff and lifeless; I put one of them in my bosom between my skin and shirt, and laid another on a board, the sun shining full and warm upon it; and one or two of my companions did the like.

"That in my bosom revived in about a quarter of an hour; feeling it move, I took it out to look at it, and saw it stretch itself upon my hand; but perceiving it not sufficiently come to itself, I put it in again; in about another quarter, feeling it flutter pretty briskly, I took it out, and admired it. Being now perfectly recovered, before I was aware, it took flight; the covering of the boat, prevented my seeing where it went. The bird on the board, though exposed to a full sun, yet I presume from a chillness of the air, did not revive so as to be able to fly."

This opinion, that the swallow is capa-

ble of living many months without breathing, or receiving any kind of nourishment, is stigmatized as superstitious, absurd, and betraying the grossest ignorance of the physiology of birds, and the conformation of their vital organs. It is not our intention to revive an exploded doctrine, or to deny that it is the general habit of swallows to retire southward from Europe during the winter season ; but the fact of those birds being found in a dormant state, and frequently entirely immersed in water, is attested by so many respectable authorities, that we are almost compelled to admit its truth, notwithstanding its positive and vehement denial by others. Not only the tortoise, lizards, toads, and other animals of inferior rank, are known to hybernate in a dormant state, but others of more perfect organization, of which the dormouse is a striking example, will remain for a considerable period without food of any kind, and without any visible motion, but are restored to active life by exposure to heat. During the winter season, some solitary swallows are occasionally found in this and other countries in Europe ; these have probably been hatched too late in the season to attain sufficient strength to join the general emigration ; and Nature, who has provided for the wants of all her creatures, may have reserved this resource for the abandoned and helpless swallow. The migratory habits of various animals, especially some of the inferior orders, as frogs, crabs, eels, fish, flies, &c., may be watched and traced throughout their operations. It is an exceedingly curious and interesting subject, and will be the theme of another article ; for the present, we conclude with an extract from "The Field Naturalist's Magazine," conducted by Professor Rennie, of King's College, London :—

"I shall give some observations on the periodical and frequently long journeys performed by several species of erratic birds, and on the points of re-union and departure which they appear to select. The yearlings and the old ones rarely go together in these journeys, which are more or less extended, as the necessity of seeking a fresh supply of food for other climates, obliges them to quit those places which fail at certain seasons to furnish them with the means of subsistence. I think I have traced the separation of families, and their re-union in bands, of ages more or less equal, to a very natural cause, produced by the difference in the time of moulting in the old and young ; and this also appears to be the cause that the bands composed of adults migrate to a much greater distance, whether in autumn, or at their return in spring, than the bands composed of young ones, which do not, in either season, extend their journey so far. The plumage of these birds being still imperfect, and the colour not yet durable, they are generally one or two years old before they are in a state to breed ; they then choose those places where adults of their own species do not build their nests, the latter always expelling them from the districts which are to give birth to a new progeny. When the old ones extend their journey to the arctic regions, those of one or two years old are found in the middle countries of Europe, and when the old ones choose the temperate climates, the young ones remain at the south, or at farthest do not pass the seas which separate Europe from the northern parts of Africa ; countries in which the greater number of the largest species of our erratic birds, that do not perfect their growth within the first year, choose to reside in winter. It is from these countries, or the numerous islands of the Archipelago, and those of the Mediterranean and the Gulf of Venice, that they set off on their return in the spring ; numerous flocks are then seen on all our southern coasts, especially where the sea forms large gulfs, such as the Archipelago, the Adriatic Gulf, and those of Genoa and Lyons. These meetings continue eight, ten, or at most fifteen days ; in which time the passage of those countries is completed.

The routes taken by water-fowl and birds which frequent marshes, depend very much on the course of rivers, and the beds of the great lakes ; the waters furnishing to each species its proper food, they seem to be impelled by a wonderful instinct, to choose for a rallying point and place of departure, those spots whence the passage from the great sea to the lakes and rivers is shortest and least occupied by land. Thus the bands that assemble on the environs of Genoa and Lyons, repair forthwith to the banks of the Po ; following afterwards the passes of the great valleys of the Alps, which descend into Piedmont, they rise above the mountains, where different species of the birds in question are annually killed. From these points they appear to direct their flight towards the great lakes of Switzerland, particularly that of Geneva, which all the water and fen birds of Europe resort to for a short period, or pass more or less regularly, from this they seem to continue their journey by the lakes of Morat, Neufchatel, and Bienne, and repair to the Rhine, the course of which they follow,

and thus arrive at the Baltic, the great inland, and North Seas. These companies, already less numerous when they arrive in the north, disperse themselves soon afterwards. At this period the individuals pair and attend to the wants of their new progeny. The route most frequented by all the water-birds is along the borders of the sea; those which come from the Gulf of Gascony, from Spain, and the coasts of Barbary, appear to follow that only; several species of waders follow it uniformly; and the same route is taken by all those birds which are unprovided with powerful means of flight. The divers, the grebes, and other fresh-water fowl, which seldom fly when occupied with the cares of paring and breeding, are, however, endowed with great powers for this action; their flight is vigorous and long sustained; they rise even above the high mountains, for it is not rare to find individuals of these species on the lakes of the Alps, where the waders and web-footed species are often killed. It appears that the great flocks which assemble in the Ionian Isles, and the vast marshes between Venice and Trieste, follow in their travels the course of the Tagliamento and Klagenfort; they visit the immense marshes which form the lakes Balaton and Neuzidel, where several species remain, while others reascend the Danube, and continue the journey to the Baltic Sea. On the lakes of Hungary, and upon the Danube, several species are found, which also visit the shores of the ocean. It appears to me that the species most peculiar to the western counties assemble in the Archipelago, and on the borders of the Black Sea; they re-ascend the Danube, and, following the course of the river, arrive in Hungary and Austria, countries that abound with various species of birds, in great numbers. I have not travelled over the whole extent of country crossed by the birds in the latter migration, nor that which takes place from the Gulf of Lyons by the mouths of the Rhone, along that river, and by the Doubs, the way by which their companions reach the Rhine. The banks of this river are peopled in spring and autumn by a great number of birds: we find in the part which forms the boundary of the western countries of Germany, all the species which go by the shores of the ocean and the Baltic Sea.

"It is, however, very rarely that we see companies composed of old ones; these seem to come more frequently by chance, and separately: the yearlings of almost every species pass regularly by these parts of the sea, and they are generally young individuals, or only one or two years old, such as are killed on the great lakes of Switzerland and Italy. It should be understood, that the species which do not continue their periodical journey so far as the North Sea and the Baltic, are exceptions; the old ones among the latter never stray to the northern climates, and it would be an extremely rare circumstance to find a young one there."

THE KENT ZOOLOGICAL AND BOTANICAL GARDENS.

On Thursday, 8th instant, a party of citizens visited this delightful spot in a steamer, when about 650 gentlemen and ladies were regaled with a *déjuener*, under a spacious pavillion erected in the gardens for the occasion. The exertions of the proprietors to improve by artifice the natural beauties of the locality which they have so judiciously chosen, and the acquisitions they have already made of numerous zoological and botanical specimens, render it easy to predict, that our former anticipations of the success of the undertaking, will be speedily and brilliantly realized. The reader may form some idea of the natural advantages of the situation, and the liberality and good taste displayed by the directors and managers of the establishment, by the following description of the gardens in their present state, which we extract from an article in the *Morning Herald*. Immediately behind the Rosherville Pier, which raises its graceful, yet simple proportions along the river side, just before the arrival at Gravesend, the land runs low until it meets, at perhaps a half mile's distance, cliffs quite worthy of Kent, but whose heights have long been overshadowed by shrubs, and their rugged face, overshadowed with verdant parasites. This piece of land, or the greater portion of it, consisting of seventeen acres, was taken into its hands by a company of gentlemen more than a year since, and by them it was made the object of a most extensive plan for the securing of its natural beauties, and adding to it new and unusual attractions. As the edge of the cliff belongs to them, they have raised a wall at a short distance from it, and by this means quite exclude the view of all who may be on the wrong side of their defence. Although great sums of money have been already laid out in this undertaking, it is yet far from finished, although what has been done is highly interesting, and everything bears testimony of the zeal of the company to proceed. When

the visitor enters the place, he sees before him the varied surface of the cliff carried off into an almost romantic distance. Immediately before him are terraces leading downward to the first level ground; it is called the Italian terrace, and is to be ornamented with copies of the best sculpture. A further advance in the valley conducts to the botanical beds, where it is intended to cultivate the rarest plants and flowers which the climate will allow. Much has already been done in this part of the general design, and the place abounds in flowers and young shrubs of the rarest British classes. Immediately next the perpendicular cliffs of these two divisions arrangements are to be made, and are in progress for the reception of wild beasts, birds, and sea-fowl. Two noble tigers, an eagle, two bears, a small monkey, and Cape sheep, are already in the custody of the Company. Passing through a causeway made through a promontorial portion of the cliff, the visitor now finds himself in a new and very charming scene, where a fine piece of level turf is almost surrounded by its lofty guardians, which bear a large portion of old grown plants upon their picturesque and broken sides. Finally, another causeway through the hill leads to the third and last glen, if we may use the word, in which much more striking wild scenery is to be found, and in which also extensive pieces of water are to be found, and in which also extensive pieces of water are prepared for wild fowl, and that quaint puzzle, a woodland labyrinth is set. Passages cut up from bottom to top of the cliff, enabling even females to ascend easily to the latter, add to the general scenic advantages of the place. Upon one of the highest points of the whole range, it is intended to build a *camera obscura*. Few persons who had not known this region well, could have supposed that it contained naturally so much of what must be considered a fine species of landscape scenery, and fewer are those who could have expected to see the bold and strange designs for the increase of its attractions so admirably executed. Yet so it is. We have remarked, that the opening yesterday was but temporary; in fact, with so much to do, to bring the whole design into full execution, notwithstanding all that has been done, it is considered by the directors that it would be better to postpone that act until the year 1840.

PARIS AND VERSAILLES RAILWAY.

To the Editor of the Mechanic and Chemist.

Sir,—The opening of the railway from Paris to Versailles took place on Friday she 2nd instant. The Dukes of Orleans, Nemours, Aumali, and Montpensier, were at the head of the train, in which were seen with the director the Ministers of War, the Interior, and of Commerce, and many other persons of first eminence in rank and science. The train started from the Place de l'Europe, at a little after half past three, it was composed of five carriages, containing about 100 persons, which were conveyed to Versailles, by a powerfnl engine, up on an ascent of 6005 m. in less than 32 minutes; coming back it ran the same distance in 25 minutes, without reckoning the stoppage at St. Cloud. Therefore an engine drawing the above would go at the rate of 30 miles up the ascent on the Versailles line, and 36 miles miles down the descent.

The names of the persons who superintended the construction of this railway, are M. Perriére, the director, MM. Clapeyron, Flachet, Mony and Lefort, engineers, and Mr. Armand, the architect. The Duke of Orleans remitted 500 francs to M. Clapeyron, to be distributed amongst the mechanics. The railroad was opened to the public on Sunday. A train will start from Paris every hour, from a quarter to seven in the morning till a quarter past ten at night. The price in the first class carriages is 1 fr. 80 centimes, or 1*s*. 6*d*., and in the second class carriages it is 1 fr. 50 centimes, or 1*s*. 3*d*.

J. M.

Twickenham.

UNIVERSALITY OF VEGETABLE LIFE.

The following observations on the universality of vegetable life, are made by Mr. Turner in his "Sacred History of the World." It may be fairly asked, says he, how is vegetation found on places that are known to have originally had none? This question is reasonable, which the following facts satisfactorily prove. The clouds ever floating above us, not only bring us occasionally meteoric stones, hail, and epidemics, but also vegetable seeds, and the very lichens that would commence the new reign of vegetation on the bleak rocks of the South Polar Isles. Dust and sands, heavier than many seeds, are borne by the winds and clouds for several hundred miles across the atmosphere, falling on the earth and seas as they pass along.

The sea and its tides and currents convey larger bodies for even thousands of miles. The winds carry over the seeds of large trees, and disperse new vegetations with an extraordinary rapidity, and to an extent which, anterior to the experience, we should not have expected. Birds also largely diffuse them. Many of these tenants of the trees and air live on fruit and berries. They digest the pulp, and pass the seeds unimpaired, and thus heavy organizations of future trees are planted in the most distant and unexpected situations. The digestive action of the feathered race upon them improves, in some cases, instead of injuring their growing energy. Waves, winds, and birds, fully explain the vegetations of every coral and volcanic island. The amazing muscular power and vital energy of birds to sustain their flights in their migrations, will account for the plantations of the most distant isles and continents. Even insects people inland ponds and streams with fish,* and are often themselves carried by the winds to great distances. From all these facts, we can easily perceive how the most remote and unvisited regions have derived vegetation. We need not have recourse to the unsupported hypothesis of spontaneous production, which no circumstance that has been fully understood, has at any time occurred to prove. When once a vegetable has become rooted in a soil, it is capable, if unchecked, of operating to an indefinite extent. One tree has, in some regions, propagated into a large forest. But the possible produce which may issue from a single individual of this department of nature, like other facts that have been noticed, extends into calculations which exceed our comprehending faculties. The just conclusion, from the experience of all ages and countries is, that spontaneous production is no part of the system for the perpetuation of the vegetable race.

PARACHUTE DESCENT.

Mr. Hampton, having announced his third parachute descent, an immense concourse of spectators assembled on Monday last, in and about the Flora tea-gardens, Bayswater, to witness this perilous exhibition. The evening was serene, and the atmosphere so clear, that when the balloon was liberated, it arose most majestically in an almost perpendicular direction, amidst the universal shout of many thousands. Having attained an altitude of—say a mile—the intrepid aeronaut severed himself from the balloon, and for the first few moments descended with fearful rapidity. Shortly afterwards, however, his frail bark assumed a more steady appearance, and Mr. Hampton would doubtless have alighted in perfect safety, had not the parachute come in contact with one of the tall trees in Kensington Gardens, by which, as we are informed, he received some trifling injuries. The balloon, not havingcollapsed, as was intended, ascended to an almost incalculable height, and is gone we know not whither.

Hydrophobia.—Mr. Murray, known as a lecturer on chemistry, and author of several chemical works, has recently written a letter to the editor of the *Manchester Guardian*, embodying his opinion as to the nature of the disease of hydrophobia, and the means of curing it. The following is the remedy he proposes:—" Let a mixture of two parts of nitric and one part of muriatic acid, both by measure (evolving chlorine in a concentrated form), be applied to the wound as soon as possible, and more than once. I thus treated the wounds of a man whose hand had been dreadfully lacerated by a mad dog, while separating another dog from its attack; and as the latter became also rabid, it afforded full proof that rabid virus was at its maximum of malignity. Nearly fifteen years have rolled away, and the man has continued free from hydrophobic attack."

Population of Algiers.—The European population of the French possessions in northern Africa, exclusive of the troops, was calculated on the 1st of the present month, at 22,607 individuals. Of these, 9,708 were French; 2,533 English; 6,969 Spaniards; 2,304 Italians; and 1,093 Germans, Russians, Greeks, Portuguese, &c.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Aug. 21, R. A. Ogilvie, Esq., on Electricity. Friday, Aug. 23, J. C. Bowles, Esq,, on Lithography. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Aug. 22, William Jones, Esq., (Surgeon to the Blenhiem-street Infirmary), on Animal Mechanics. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Aug. 20, T. Claxton, Esq., on Mechanics' Institutions. At a quarter to nine.

QUERIES.

1. I have effected some drawings by the photogenic process, and fixed them by inserting in a solution of salt in water; the black parts have, however, changed to a chocolate brown, of different shades, according to the time left in the liquid. What is the reason, and what must I do to preserve the blackness?

2. Has any one among your readers in Brigh-

* The great river beetle which lives habitually on eggs of fish, climbs sometimes in the evening on the reeds high enough for its flight, and then takes wing. One was caught in its flight, and being put into water, it emitted the eggs with which it was gorged; some in part digested, and some not at all. These eggs produced fish of various sorts.—*Bull. Univ.*

ton or its vicinity, a good, but not expensive, electrical machine to dispose of; if so, please to favour me with the way of obtaining particulars?

3. What rules guide the astronomer in ascertaining the immense distances of the stars?

4. What is the best varnish for engraving? I have seen some which, so done, looked like oil paintings.

5. What is the supposed method of Baxter's oil-colour printing?

6, Has any thing more been heard respecting animal magnetism?

7. A way to make imitative amber?

MELEK RIC.

[Most of these queries have been answered, or commented upon, in the "Mechanic;" we, however insert them, as they chiefly relate to subjects of general interest, and are calculated to elicit useful information.—ED.]

Where can I obtain the tongues proper for an accordion? As I am about to make one on a plan of my own, which, when I have completed, I shall be happy to send you a description of.

J. B.

[Make them of thin rolled brass, about the thickness of clock springs; this material may be obtained at any of the watchmaker's tool shops. There are different kinds of flat brass; the proper sort is called *hard* rolled brass. The vibrating part of the springs, in the upper notes, should be little thicker than stout paper. The bass notes are produced by making the ends of the springs heavy, and weakening the back part, or root, next to the foot by which they are attached. They should fit very exactly into the holes which receive them, and stand even with, or a very little above the surface by which the wind enters. They are easily tuned, by reducing the extremity to sharpen, and the root to flatten them. It will be found convenient to procure a diapazon of some kind, from which each note may be separately copied—a piano-forte will do if recently and carefully tuned. Red gold of about fourteen carats, makes excellent springs for this purpose, especially if the instrument is intended to be played by the breath; these, as well as the brass ones, should be well hardened by hammering.—ED.]

ANSWERS TO QUERIES.

To Silver Glass.—"J. B." Cut a piece of tinfoil larger than the glass intended to be silvered, and lay it upon a flat piece of board or stone, and with a straight piece of wood smooth it, so that there be no wrinkles in it; then pour a small quantity of mercury on it, and with a piece of cotton wool spread it all over the foil, so that every part may be covered with the mercury; then place the piece of glass you intend to silver upon it, and place weights upon the glass, so as to press the silvered foil quite close to the glass and let it stay in the position for two or three hours, and the glass will be found silvered. Let the glass be as clean as possible on the side intended to be silvered.

Gold Size.—I believe the gold size for gilding picture frames meant by "J. B.", is made by grinding yellow ochre with boiled oil.

J. MITCHELL.

TO CORRESPONDENTS.

C. H.—*The Daguerrotype will take a correct drawing of any accessible building,* to any given scale *(within certain limits), by placing the instrument nearer to, or further from, the object. Some of our correspondents will, no doubt, be obliging enough to supply the information which is immediately required. In the other question,* "H." *is* unquestionably *wrong, and* "C." questionably *right. A nation may be personified, as when we speak of "Britannia," or "John Bull;" the former is more poetical and serious, and more comprehensive in its meaning than the latter. "Britannia" generally applies to the whole united kingdom, and "John Bull" exclusively to England; nearly in the same sense as the title of "Jaques Bon Homme" (an easy, enduring person) adopted by the French to designate and characterize their nation. An elegant French writer calls Italy "La Belle Esclave" (the beautiful slave), alluding to the subjugation of a great portion of that fine country to the power of Austria; all those, and other similar expressions, are, and must be, employed in the singular number. With respect to "C.'s" version, it is contrary to custom and good taste, to employ the word "English" as a substantive without prefixing the word "the"; it should have been "Englishmen," or "Britons." But we should like to see the motto entirely altered; instead of the very equivocal expression "liberty," which often degenerates into licentiousness, as experience has shown in more recent occurrences than the revolution in 1793, let* "Justice to all," *be the motto; for so sacred is that sentiment, that no man can contend against it, without condemning himself. It is not our business to interfere with political questions, nor to inquire whether there are at the present day, such things as insidious leaders, or rather misleaders, seducing the unwary by specious and fallacious promises, to neglect their best interests, and follow after phantoms which can never be attained. Such has been the case, and it may so happen again; therefore the best advice we can give to the operative community of this country, is, that every man, according to his means and his wants, should obtain for himself, or for his children, the greatest possible amount of useful instruction, which will enable them to think and act soberly and wisely; to cultivate and improve the arts which furnish them with employment, and bid defiance to the demagogue at home, and the rival manufacturer abroad.*

S. Walter's *communication will appear as soon as the engravings are ready. Various communications and answers to correspondents are unavoidably deferred till next week, owing to a want of space.*

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THE

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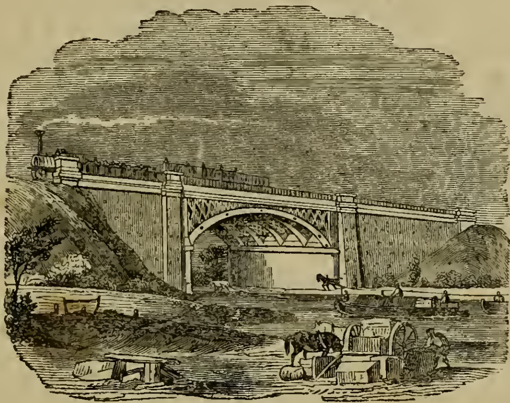
THE LONDON AND BIRMINGHAM RAILWAY.

VIEWS OF THE BRIDGE OVER THE REGENT'S CANAL, NEAR PRIMROSE HILL.



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PHOTOGENY.

DISCLOSURE OF DAGUERRE'S PROCESS.

At the last meeting of the French Academy of Sciences, M. Arago announced the intentions of the Minister of State for the home department, respecting the first publication of M. Daguerre's process of fixing the image of the camera obscura. The law (Act of Parliament), which awards a recompense to MM. Daguerre and Niepce for this magnificent discovery, prescribes as a condition, that the whole secret shall be divulged and made public. The Minister has considered that the fittest mode of publication would be a communication to the Academy; and Monday the 19th instant was accordingly fixed upon for the intensely desired revelation. Our next number will contain M. Arago's communication; and the reader of the "Mechanic" next week, will be in possession of the long-expected information, which all the talent and learning of Europe have been unable to supply.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 316.)

The roof is of timber framework, with strong beams reaching across. One of the branches of the river Thames rises on the south east, in this parish, from two separate springs; it runs by Boxmoor into Oxfordshire. At the western extremity of the town, is one of the few remaining monasteries still in a condition to be inhabited; it is a brick building, ribbed with oak or chesnut (which latter is often mistaken for oak in old buildings) situated in a large garden enclosed by a wall. The present occupant, a farmer, lets it in lodgings, chiefly to labourers; the cells of the monks may still be seen, and in the lofty vaulted chambers may be traced carvings of armorial bearings and other memorials proclaiming names and deeds, long since lost in the darkness of oblivion, or only seen through the deceptive mists of tradition. But relics of a different description were discovered a short time ago: in removing the floor from one of the apartments, it was found that a considerable number of human bodies had been deposited there; a circumstance which cannot be explained by any existing records. Some charitably surmise that a sepulchral vault formerly existed on that spot; others consider them as tokens of some of those crimes, of which the history of the human race, especially at the dark period which preceded the dissolution, unhappily presents too many examples; and the present more refined generation,

> "Not dreaming of priest's cruelty,
> Wonder such relics there should be.'

A short distance from the town, on the north side, are the extensive silk mills of Messrs. Evans and Co., of London; they give employment to a great number of females, and when in full activity, are capable of occupying seven hundred persons. The ancient Roman way, Ikenild-street, crosses the road at this place, and runs east and west. A little further on, are the reservoirs of the Grand Junction Canal; on the banks of these little lakes, numerous threads are observed, having a maggot attached to one end, and a disciple of Isaac Walton at the other. These reservoirs are supplied by springs, and the water is conveyed into the canal by means of a steam engine.

There is a story related in "Hughson's Perambulations," of one of the grossest and most cruel outrages, ever suggested by ignorance and superstition; it occurred at Tring, in the year 1751. It is painful to record the depravity of mankind, but it is equally consoling to contemplate the great social improvement of the present generation. Superstition is a nightmare in the dream of life; a spectre which flies from the presence of knowledge, as ghosts were formerly said to vanish at the crowing of a cock; it still exists in some weak minds, but with the exception of such occasional relapses as happened a short time ago, in the case of Thoms and his followers in Kent, it may be said to be subdued, tamed, and confined within the limits of the law.

"Some country people were possessed of an opinion, that an old man and woman of that town, John and Ruth Osborne, were witches, on account of several cattle dying of a contagion which then raged; great numbers of them assembled, some on horseback, and others on foot, and went and had them proclaimed as such, in three different market towns. These unfortunate people were afterwards dragged from the vestry of the church, where they

had been concealed, and so severely ducked, that the woman died on the spot, and the man a few days afterwards. Several persons were committed to custody on the verdict of the coroner's jury; and one Thomas Colley (who, though a principal actor in this horrid affair, was prompted by others, and by the liquor which he had drunk), was tried at the ensuing assizes for Hertfordshire, and capitally convicted. It came out at the trial that, on the 18th of April, 1751, one Nicholls came to William Dell, the crier of Hemel Hempstead, and gave him a piece of paper, with fourpence, that he might cry the words written thereon in the market place. The words were these :—'This is to give notice, that on Monday next a man and woman are to be publicly ducked at Tring in this county, for their wicked crimes.'

The overseer of the parish, where these people lived, having heard this cried at Winslow, Leighton Buzzard, and Hemel Hempstead, on the several market days, and being informed that the two people were John Osborne and Ruth his wife, he sent them to the workhouse for safety. The master of the workhouse, to make still more secure, removed them in the middle of the night of the 21st, into the vestry-room of the church, thinking the sanctity of the place would have some awe upon the mob, if they came. However, on the day appointed, more than five thousand people were collected together at Tring, declaring revenge against Osborne and his wife as a wizard and witch: they pulled down a large wall belonging to the workhouse—the ancient priory—and demolished the windows and window-frames. The master of the workhouse assured them they were not there; the mob would not believe him, but rushed in and searched the house, the closets, and even the boxes and trunks. They declared they would pull the house down if the victims were not produced, and some proposed setting fire to it: at last they all swore, that, if Osborne and his wife were not delivered to them, they would not only burn the workhouse, but the whole town of Tring. The master being apprehensive that they would do as they had promised, at length informed them where the unhappy people were. The mob now went off in triumph, with Colley at their head. As soon as the mob entered the vestry-room, they seized Osborne and his wife, and carried them to a place called Gubblecote, about two miles off, where, not finding a pond to their purpose, they carried them to Wilston Green, and put them into separate rooms in a house there; they stripped them naked, and tied them up separately in a sheet, but first they crossed the man's legs and arms, *and bent his body so as to tie his thumbs to his great toes.*

When they came to the pond, called Wilston Wear, a rope was tied under the armpits of Ruth Osborne, and two men dragged her through the pond, and Colley turned her several times over and over with a stick. After they had ducked the woman, they brought her to land, and then dragged the old man in and ducked him. Then he was set aside, and the woman ducked again as before, and Colley made the same use of his stick. Then the old man was ducked again. After which the woman was a third time ducked; and Colley went into the pond and pulled her about until the sheet wherein she was wrapped came off, and she appeared naked. She expired soon afterwards. Colley then came out of the pond, and went round collecting money for the sport he had shown them in ducking the old witch, as he called her. After the woman was dead, the mob carried John Osborne to a house, and put him to bed, *and laid his dead wife by his side.* Ruth Osborne was seventy years of age; John was fifty-six. In consequence of these circumstances of cruelty, Colley was ordered for immediate execution, and his body was afterwards hung in chains, at Gubblecote, in the parish of Tring, three miles off.

Another instance of credulity and superstition occurred in this neighbourhood in the year 1759. At Wingrove, one Susannah Hannokes, an elderly woman, was accused by her neighbour of being a witch; for that she had *bewitched her spinning-wheel*, so that she could not make it go round, and offered to make oath of it before a magistrate; on which the husband of the poor woman, in order to justify his wife, insisted upon *her being tried by the church Bible*! and that the accuser should be present; she was conducted by her husband to the ordeal, attended by a great concourse of people, who flocked to the parish church to see the ceremony, where she was stripped of her clothes to her shift and under petticoat, and *weighed against the Bible!* when, to the no small mortification of her accuser, *she outweighed it, and was honourably acquitted* of the charge."

AYLESBURY is a market town in Buckinghamshire, seven miles from Tring, and 38 from London. It is an ancient town, and was one of the strongest fortresses of the ancient Britons; it maintained its independence till the year 571, when it was

captured by Cuthwolf, brother to Cealwin, king of the West Saxons, who called it Æglesbury. It is situated on an eminence, surrounded by a delightful tract of country, called the Vale of Aylesbury. This vale contains some of the finest land in the kingdom, and affords pasturage for an amazing number of sheep. Aylesbury is an incorporated town, and sends two members to Parliament. A market is held on Saturday, and fairs on the Friday after January 18th, the Saturday before Palm Sunday, May 8, June 14, September 25, and October 11.

The church, dedicated to St. Mary, is an ancient and spacious structure, in the form of a cross, with a low tower rising from the intersection of the nave and transept. The pulpit is curiously carved, and worthy of the attention of the visitor. This town and its neighbouring villages, are renowned for rearing young ducks in the winter, which is a source of much profit, owing to the high prices they obtain in London.

The manufacture of pillow lace at Aylesbury, High Wycomb, and the adjacent villages, and also in some other surrounding counties, is still carried on to a great extent; but it has considerably declined since the introduction of various successive improvements in the Nottingham manufacture. The imitation of pillow lace (that is, lace made by hand), is one of the most striking examples of the triumph of machinery. The depreciation in the price of bobbin nett made at Nottingham within about five-and-twenty years, must appear almost incredible to those who are unacquainted with the trade; *four and five quarters plain nett, which was formerly sold at five guineas per yard, may now be purchased at about six pence, clearer and better made!* The average wages now obtained in Buckinghamshire, amount only to about sixpence per day; and even this miserable pittance is usually paid in merchandize, consisting of the necessary articles of life. The present price of pillow lace is from twopence to twenty-five shillings per yard, being a depreciation of not more than one-third of the price obtained twenty-five years ago.

PHOTOGENIC PRINTING.

To the Editor of the Mechanic and Chemist.

Sir,—I am obliged to you for inserting my letter on photogeny last week, but fearing lest it might be misunderstood, I beg to say, that the process therein detailed, is such as has been practised with so much success by Mr. J. Robinson, No. 8, Stone-street, Bedford-square, and who was, I believe, the first that succeeded in fixing the drawings and preparing an even paper. I forgot also to state, that I had applied the photogenic art for printing on muslin and silk, a specimen of each of which I now send you, but whether the peculiar nature of the proccss will admit of its being introduced on a large scale in the manufactories, I am not prepared to say, it nevertheless, however, appears to offer such an application.

I am yours, &c.

W. H. Hewett.

[One of the specimens, the figure of a soldier, is as perfectly delineated as a good impression from a copper-plate engraving; the impressions of lace and tambour work are also very good, though not sufficiently perfect for articles of commerce. If perfectly white figures could be produced on a good equal black ground, the invention would be of considerable importance and value; especially in the imitation of tambour work, which is not yet superceded by machinery, and is consequently attended with great expense. We considered this new application of the photogenic art of so much importance, as to entertain some doubts of the expediency of publishing it; but considering the anxiety, expense, and, moreover the precarious guarantee of a patent, and the danger of the idea being taken up and explored by others, we accede to the wish of our correspondent in recording his invention, thus securing to him an undeniable proof of priority, should the invention be claimed by others, at any future period. As one cause of imperfection is the partial translucidity of the fine threads of lace, it might perhaps be advantageous to expose the articles to a long continued action of moderate light, rather than the direct penetrating rays of the sun. If a pattern or model could be formed of fine brass wire in the manner of metallic cloth, this inconvenience would be completely overcome, and it would only remain to produce a dark ground of equal colour throughout, to render the process immediately applicable to objects of manufacture. We recommend our correspondent to continue his experiments, heartily wishing him that success which the ingenuity of the idea deserves, and which his first productions appear to predict. The specimens will be left at the "Mechanic" office; but Mr. H. is requested to send his signature, or an impression of his seal, otherwise an unpleasant mistake might occur.—Ed.]

PIRACY BY LETTERS PATENT.

To the Editor of the Mechanic and Chemist.

Sir,—Having seen in a list of patents, that one Samuel Stocker, of Bristol, has taken out one dated February 21, 1839, for, as he calls it, a new method of manufacturing chimneys for dwelling houses, and for new apparatus for clearing or sweeping chimneys to supercede the use of climbing boys, I felt anxious to know the particulars of his specification. I went this morning to Roll's Chambers, Chancery-lane, and examined the specification, and which I there find to be the identical same, almost word for word as that which I forwarded to you in November, 1837, and which you were so kind as to insert in No. 56, page 124, November 18th, 1837, of your useful magazine, together with a very flattering note of your own. My object in addressing you is, to know whether any party can take out a patent for an article that has been made public before; and whether, if I were to manufacture the simple application for my own gain, I should be liable to be stopped by him for so doing; as I have not made any further than that which I have made and applied in the house in which I reside (for the reasons I stated to you in one of my letters at that time, not having time or means at my command), and which I find to answer well, having been in use nearly three years.

I am, Sir, yours obediently,
A. M'Gillivray.
38, Clarendon Square, Somers Town.

[The patent is void *per se;* letters patent granted for new inventions, declare the patent void *if the thing invented have been in use before the date of the grant,* or *if the patentee be not the inventor.* But

" I know you lawyers can with ease,
Twist words and meanings as you please;"

and they are encouraged and assisted in the pleasant and (to them) profitable work, by the glorious ambiguity of the concluding sentence of the letter, which declares that all things previously stipulated, are to be *construed* in the sense most beneficial to the patentee. The present case is, however, so very flagrant, that even lawyers would hesitate to contend that the invention was new, after it had been minutely and publicly described to more than fifty thousand persons. We advise our correspondent to communicate with Mr. Stocker on the subject, and endeavour to make some amicable arrangement. It is necessary to state, that we have not examined the specification of Mr. Stocker's patent, and cannot, therefore, assert that it contains no such deviation from Mr. Gillivray's invention, as might be *construed* by the squinting eyes of the law, into a new discovery.—Ed.]

SURVEYOR'S WALKING-STICK.

To the Editor of the Mechanic and Chemist.

Sir,—Having seen a very ingenious contrivance for a " surveyor's walking-stick," and deeming it a subject not uninteresting to a general reader, I send a sketch and description of the same.

A, is a knob (circular), into which a small compass is let; B, is a small telescope, which can be lengthened on one side. If the handle be unscrewed at C, in the long part, will be seen, neatly fitted, two five-feet rods. These rods have joints in the middle to render them sufficiently short for the stick. When in use, they are secured by square ferrules. Altogether, it is a most compact, neat, and useful contrivance.

I am yours, &c.
Proportio.

GLASGOW, PAISLEY, AND AYR RAILWAY.

EXPERIMENTAL TRIP.

(From the Ayr Observer.)

The weather, being very wet at intervals, was unfavourable for a large turn out of the inhabitants. Nevertheless, long before the hour, a considerable crowd had collected and lined the course of the railway for several miles. Immediately at the hour appointed—everything connected with the machinery and carriages having previously undergone a careful inspection—the party took their seats, and the train was speedily put in motion, amidst the cheers of the onlookers. From the first carriage waved a brilliant scarlet silk flag, enwrought with the arms of the Company; and the sight was altogether grand and imposing, such as few in this part of the country had ever witnessed, and still fewer expected within a year or two ago, to have seen so near their own doors. Proceeding with due caution for some time, the performance of the first mile took nearly five minutes; but gathering rapidity as the train cleared the town, the next was accomplished in three, the third in two and a half, and the fourth in

two and a quarter. It was impossible, however, to calculate the subsequent progress with any degree of accuracy. As the train passed along, the enthusiasm of the people seemed to increase, and on every little knoll parties were congregated to give the welcome cheer as it glided on with the speed of the eagle. Opposite Fairfield House several shots were fired by parties who had taken their station for the purpose; and at one or two other points the Directors were greeted with similar marks of enthusiasm. Flags were also displayed from various eminences; and the Troon bridge was decorated with no fewer than five colours waving in the breeze, while the parapets were surrounded by a vast crowd, cheering with Stentor lungs as the train passed swiftly through the arch beneath them. Sweeping along, it was amusing to observe the alarm created among the horses and cattle grazing in the adjacent fields, which, unaccustomed to have their solitude broken in upon by a sight so unusual, might be seen scampering away in all directions, as if the mighty Jupiter, father of *Mercury* (the name of the engine) had been himself in pursuit of them! On arriving at the crossing of the Troon Railway, the train halted for upwards of eight minutes, during which a number of Kilmarnock people, who had walked out from Troon, were afforded an opportunity of gratifying their curiosity. At length *Mercury* proceeded on his mission till within little more than a mile of Irvine, when it became necessary to check his flight, and a halt of upwards of eighteen minutes took place. This arose from the deficiency and bad quality of the fuel. The steam having at length been got up, the train proceeded rapidly to Irvine, which was reached about four minutes past one—the journey having thus been performed, exclusive of twenty-eight and a half minutes' stoppage, in thirty-five and a half minutes. Refreshments were amply provided at the terminus at Irvine, where the party were joined by several other Directors and friends, and the time was very agreeably spent till the hour (two o'clock) fixed for returning to Ayr. Notwithstanding that it rained very heavily, a large concourse of people were congregated to witness the starting. Leaving Irvine exactly at two o'clock, with a considerable addition to the number of passengers, it soon became evident, from the increased speed of the engine, that a proper supply of fuel had been procured. Proceeding on some portions of the way at the rate of thirty-six miles an hour, as was the case more especially when opposite Fullarton House, the seat of the Duke of Portland, we had now a more perfect idea of the capabilities of the machinery, and the exhilarating sensation arising from the velocity of railway travelling. The smoothness with which one is whirled along is such, that were it not for the fast receding objects which are left behind, we might remain almost unconscious of progression. Considering the newness of the engine, carriages, and rails, the speed attained, and the absence of vibration, were in the highest degree flattering. Several gentlemen present, who had repeatedly travelled by other railways, remarked that they had no where experienced greater pleasure in a similar conveyance. As a proof of the total absence of anything like unequal motion, it deserves to be mentioned, that one or two gentlemen, in taking notes of the speed, were able to write with as much precision, and nearly in as fine a hand, as they could have done at their own drawing-room table. Of this we saw several specimens, and when compared with memorandums written by the same party, under other circumstances, we found difficulty in distinguishing the difference, if any at all existed. We forget, however, in this digression, that 30 miles an hour must speedily bring us to the end of our journey. After stopping for a minute at the junction of the Troon Railway, the train again started, and soon acquired its previous speed, reaching the terminus at Ayr exactly twenty-four minutes past two; thus performing the distance from Irvine, exclusive of the stoppage, in twenty-three minutes, or at an average of thirty miles an hour—a result extremely gratifying to all connected with the undertaking. The Lord Provost, who formed one of the party, repeatedly declared that he had never been more delighted in his life. We are glad to state that no accident of any kind occurred to mar the gratification arising from the propitious occasion.

LEIPSIC AND DRESDEN RAILWAY.

(From a Foreign Correspondent.)

THE first week of this month (July) has given renewed proofs of our railway becomiug more and more frequented, so much so, that it exceeds the most sanguine expectations which the public had previously formed.

On the 7th instant, 5603 persons were conveyed to the capital of Saxony, and in the presence of a Catholic, but an enlight-

ened, liberal-minded, and indulgent king, the third centennial festival of the Reformation was celebrated in a manner worthy of that great event.

Although our railway has but one track, nevertheless the 5603 persons were conveyed to Dresden without the least interruption; and it is worthy of remark here to state, that of 708,749 individuals, who since the opening of the line have been conveyed from place to place, only one person has met with an accident, and that a very slight one.

On the 7th instant, the receipts amounted to 3011 Prussian dollars, and since the 9th of April, 225 carriages have been conveyed. The construction of the Magdebrug Railroad proceeds very rapidly, and in the course of the summer 1840 it will be completed. This railway will be of great advantage to ours, as there will be a great increase of travellers and goods.

The whole of Saxony begins to appreciate the blessings of our railway, and our enlightened government, which comprehends in its full extent, the great importance and the salutary effect which our line produces throughout the land, promotes by every means at its command, the prosperity of the undertaking. More than ever there are prospects that the railway will, within a very short time, present the shareholders with gratifying results. The shares are now from 8 to 9 per cent. below par, and have begun to attract the notice of capitalists in Great Britain—the more so as they offer ample security for investment.

If it be likewise taken into consideration that locomotives, rails, wheels, and most of the machinery, are supplied by Great Britain, the prosperity of the undertaking affects, in some measure, British industry.

The present low price of the shares arises entirely from the swindling transactions which were formerly carried on by them. Before even any part of the line was opened, the shares were without any reason driven up to 40 per cent. premium. Many people were, by means of small profits already realized, enticed to renew their purchases, and, buying above their means, they were at every call obliged to sell part of their shares at any price, for the purpose of procuring the necessary funds for the payment of the instalment. It is easy enough to foresee, that all shares will eventually get into the possession of solid people, who will hold them as an investment—and thus they will attain a price equal to the profitable returns of the railway.—*Railway Times.*

HYBERNATION OF SWALLOWS.

To the Editor of the Mechanic and Chemist.

Sir,—Whilst reading your valuable magazine of August 17th, the following incidents occurred to my recollection. About six or seven years ago, when in the Highlands of Scotland, one morning about the end of August, perceiving some boys playing at the bottom of a sand hill, and seeing a great many holes in it, I asked them if they made them, and was told there were swallows in them, and that they remained there all winter; one of them struck the top of the bank with a stick, and a number of swallows flew out. A short distance from this place was a spring in the middle of a pool, about nine feet by seven, and four or five deep, it had only existed a few years, which greatly surprised me, there being fish in it from one inch to two inches long; their backs were armed with sharp weapons, which ran into my hand when I offered to grasp them; they were the same sort of fish that were in a quarry near Edinburgh. Not many yards from this miniature lake, there were several fields lately taken in from the sea, they were completely covered with grass and larch trees, that seemed to spring up spontaneously.

D. G. R.

New Penny Postage.—Numerous objections may be offered against labels and envelopes; it is, however, hoped that the Lords of the Treasury will commence by trying payment at the Post-office, now ready for their use, and through which the public may in a week's time have the advantage they are anxiously expecting; it will be time enough when this fails, to resort to more complex and expensive machinery. From the year 1794, when the Penny Post was considerably improved, to the year 1801, when it was abolished, the public readily paid in advance.—*Globe.*

Definition of Ice.—When a boy, a native of the East Indies (where, it must be remembered, there is no ice), was on a visit at the house of a friend in Edinburgh, he was shown water in a basin that had been frozen in the night. On being asked what it was, he said "It is water fallen asleep."—*Scotch Paper.*

March of refinement.—Improvement in Bill-sticking.—A number of bill-stickers, who have lately formed themselves into a company, have addressed prospectuses to the managers of theatres and other places of public entertainment, in which they style themselves "External Paper Hangers," and state that the object of the society is to contract for the posting of placards on walls and boardings of unfinished houses in the most commanding situations, which they intend to rent of the proprietors and builders for that purpose. They also express their determination to

prosecute any wandering bill-sticker who may dare to "paste" upon their "property," consisting of the aforesaid walls and boardings.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, August 28, R. A. Ogilvie, Esq., on Electricity. Friday, Aug. 30, Election of Committee. At half-past eight.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Aug. 29, William Jones, Esq., (Surgeon to the Blenhiem-street Infirmary), on Animal Mechanics. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, August 27, Mr. J. Burton on the applications of Chemistry and Machinery. At a quarter to nine.

QUERIES.

Can you or any of your correspondents inform me where I can purchase a drawing of St. George, Bloomsbury Church (the front elevation), with the plan, at or about the scale of one inch to five feet, and at what they will charge for them?
ARCHITECT.

The best method of mixing phosphate with chloride of potass, as I believe it is mixed in the Congreve matches. A SUBSCRIBER.

Where can I buy a four-way cock? Also how to make Congreves and yellow fire, and how to make cloth water-proof? To make japan for tin, and to make orangeade? T. C. A.

Being desirous of studying the higher branches of astronomy, and not being master of algebra, I am desirous of being informed of the best work on geometrical astronomy, so that I may attain my object without the aid of algebra.
ALPHA.

The process of charring human bodies, as is described in page 31, Vol. I.? Having also made a Leyden phial, as is described in Vol. I. No. 32, I have endeavoured to charge it in the manner set down, but have failed; I wish to know the cause of it, whether it is with using the tinfoil that came off one I broke. T. R. B.

1, The best treatise on steam-engines for a young beginner, with the proper scales, and where I can purchase small castings complete, either in brass or iron; I am not particular to size or pattern, and the price of both? 2. The best method of making matches, such as Congreve's, as I want them for my own use? I am not particular what sort they are, so as they are good. J. C. H. L.

Being troubled with a quantity of superfluous hair on my right temple, and seeing in No. 40 of your excellent periodical, in answer to a query, that quick lime, starch, and sulphur of arsenic, would have the desired object, I was tempted to try it, but after three trials I found it did not succeed. I should be obliged to "W. G. A. H." to explain the way in which it ought to be used rather more clearly; and I should also be glad to hear of any other ingredient that will be likely to succeed. Will the above entirely destroy the hair? I should also like to know, if there is anything that will effectually destroy hair moles without injury? A CONSTANT PURCHASER.

TO CORRESPONDENTS.

Tyro Chemicus.—*We most cordially wish success to his project; it is conceived in the best spirit of the present age. He proposes to form a society for the study of* Mechanics and Chemistry, *especially the former, the practical part of which is excluded from most of the mechanics' institutions as at present constituted. The subject shall have our earliest attention and consideration, and in our next we will offer a few remarks thereon.*

J. Mitchell *would oblige us by forwarding another drawing of fig.* 6, *in his last communication, as the one he has sent is not sufficiently distinct to prevent mistakes. The black part for the zinc, and light or shaded part for the copper, should be clearly defined.*

A Correspondent *has been informed, that we propose to increase the size of the "Mechanic," and raise the price; that is not our intention. Judging from our circulation, the plan we have now adopted, appears to meet the approbation of our subscribers. We publish two supplementary numbers in those months in which five Saturdays occur, and three in those containing only four Saturdays, thus making seven numbers in each month.*

D. G. R.'s *queries shall be attended to in our next.*

A Subscriber—*We have not found any substance which will remove the French varnish from leather as he requires; we will, however, make some further trials, and inform him of the result.*

J. S.—*Ballooning is scarcely known in France. A story lately appeared in the French papers, of an astonishing achievement in the aerostatic art. On the 29th July last, a balloon was sent up from Paris, having a bunch of crackers tied to it, to commemorate the explosion of* 1830, *and promote the glory of the citizen king. After the gas had escaped through two holes (for the French writer very sapiently argues that it must have passed that way, since no other outlet could be found), the empty rag fell into a ditch, and so alarmed the bystanders, that they fled from the place in great consternation, and a woman* "poussait aussi des cris pitoyable de frayeur," *—pushed out piteous cries of terror. We trust that this specimen will suffice to convince our correspondent that it is not "very strange and unaccountable" that we should be so silent upon the subject of French ballooning.*

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THE

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Nos. XLIII. & XLIV. NEW SERIES. | SATURDAY, AUG. 31, 1839. (PRICE TWO PENCE.) | Nos. CLXIV. & CLXV. OLD SERIES.

GALVANIC BATTERIES.

FIG. 1.

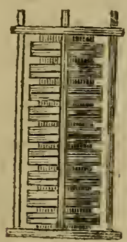


FIG. 2.

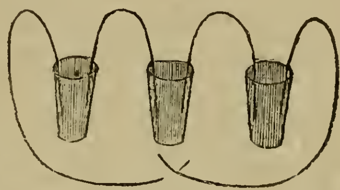
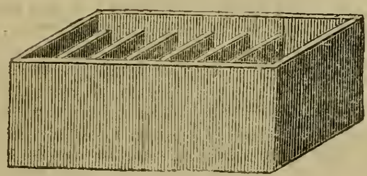


FIG. 3.



A FIGS. 4.

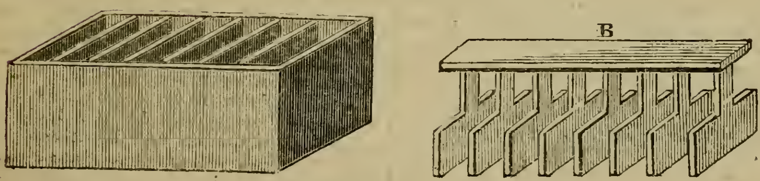
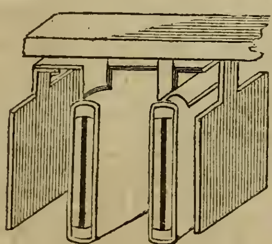


FIG. 5.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PHOTOGENY.

DISCOVERY OF MM. NIEPCE AND DAGUERRE.

Monday the 19th of August being the day appointed for the revelation of the secrets of this wonderful invention, the Academy was crowded at an early hour, although it was known that the communication which M. Arago had undertaken to deliver verbally, would not take place till three o'clock. When the appointed hour arrived, the members of the Academy of Sciences, and those of the Academy of Fine Arts, with many other distinguished persons, were assembled, and waiting in silent and anxious expectation—a silence only interrupted by a confused murmur from the impatient numbers congregated without, and unable to obtain admission.

Previous to entering into a description of the processes employed by M. Daguerre, by means of which he has obtained results so perfect, as almost to preclude the hope of any ulterior improvement, M. Arago described some less successful attempts, which preceded the experiments of MM. Niepce and Daguerre. It cannot be determined at what period it was first observed that light possesses the property of leaving a trace of its passage, by altering, more or less, the colour of bodies exposed a long time to its action. These alterations were, at first, only observed upon substances of organic origin; the action upon minerals was not known till a much later period, and, as it appears, only in the sixteenth century. In a work of Fabricius, published in 1566, it is mentioned, in speaking of a composition which the alchemists had produced from silver, and which they designated by the name of *lune* or *argent corné*. This compound is white at the moment of its formation, and blackens when exposed to the action of light; and this change is effected more or less rapidly, according to the intensity of the light. This property of the *argent corné*, did not become a subject of experiment and research, till after the fallacious science of alchemy had given place to true chemistry. Scheele was the first who conceived the idea of ascertaining if the different rays of which light is composed, possess the same discolouring power. With this view, he formed the prismatic spectrum on a surface covered with the chlorure of silver, which is supposed to be the same substance as that which in the jargon of the alchemists, was called *argent corné*; the word *lune*, or *luna* (the moon), was applied to silver, on account of some mysterious sympathy which they pretended to believe existed between silver and the moon. In this experiment he discovered that the action of the different rays was very unequal; that the red blackened the surface but very little, the yellow more, the blue still more, and the maximum of action was in the violet rays.

In 1802, it was separately discovered by Wollaston and Ritter, that it is not only in the visible parts of the spectrum that the alteration of colour is produced, but it also takes place at a certain distance beyond the violet rays, and it is even there that it is most completely produced. According to the experiments of these two chemists, it is proved that there exist in light, besides the rays which render objects visible, other rays, capable of producing certain changes in bodies, and assisting certain chemical reactions. The idea of applying the discolouring action of light to the production of designs, was not entertained till long after that property was known; and the earliest attempts that can be cited, are those of a Frenchman named Charles, and our countryman Wedgwood. Charles did not pretend to do more than produce the contour of objects, in the manner of a shadow, called by artists *silhouette*. Wedgwood aspired to something superior, and actually produced images distinguished by different degrees of light and shade; but they did not correspond with the external objects, being inverted, that is, the light parts traced in black, and the dark parts in white; but although the success of these early experiments was incomplete, it must not be forgotten that *Wedgwood was the first who applied the camera obscura to the purpose of producing photogenic pictures.* The memoir in which Wedgwood describes his process, was published in 1802.

Sir Humphrey Davy, commenting on Wedgwood, states that he had himself succeeded in copying very small objects with a solar microscope, but only at a short distance from the lens. It must be remarked, that neither Davy nor Wedgwood found the means of arresting the process of discolouration after the formation of the image. The consequence was, that the designs which they obtained, could only be viewed, as it were, by stealth, and by the feeble light of a taper, for in full day-light they would soon become all over equally black. We now proceed to the description of the experiments and discoveries of MM. Niepce and Daguerre. The researches of M. Niepce, appear to have commenced about the year 1814; in 1827, M. Niepce, being at that time in England, had obtained by means of the camera ob-

scura, and a photogenic process, pictures which possessed two great advantages over all that had been previously done: 1st. Representing the objects as they are in nature, that is to say, with the light parts corresponding with the light, the dark parts with the shadows, and the intermediate shades in their proper distribution, as they appear in the natural object. 2nd. Rendering them capable, when once formed, of supporting without further alteration, the most intense action of light. In these experiments, M. Niepce employed metallic plates instead of the paper or skin which had hitherto been used. The substance he employed to render the surface impressionable by light, was *bitumen;* he dissolved dry Judea bitumen in oil of lavender, and spread it over the polished surface of the plate, in the form of varnish; he then evaporated the oil by heat, and the bitumen remained adhering to the plate in the form of a whitish powder. Thus prepared, the plate was placed in the camera obscura, and, after some considerable time, the image was feebly impressed. M. Niepce was next conducted by a train of reasoning to conceive, that the modification operated by the action of light, was more considerable than the alterations of colour seemed to indicate. He imagined, that since the chemical action had been unequal on different portions of the surface, the same reagent would not act on all parts in the same manner; and that one might be found which would produce a more marked opposition in the colours of the parts which had been differently acted upon by light. Having placed a plate prepared as already described, into a mixture of oils of lavender and petroleum, he found that the parts on which the rays of light had fallen, remained unaltered; but those parts which had remained in the shade, dissolved in the liquid, and left the metal bare. It only remained to wash the plate, and a picture was obtained, formed by a coat of white powder in the light parts, and the bare metal for the shade; the quantity of powder remaining, varying according to the intensity of light to which the surface had been exposed, produced the intermediate shades in their proper order. The various modifications and improvements upon this process, which were subsequently introduced by the united labours of MM. Niepce and Daguerre, though not destitute of interest, we pass over for the present, as not being essential to the explanation of the present system of M. Daguerre, an accurate description of which here follows:—

The Daguerre Process.—A sheet of copper, plated with silver, is made perfectly flat, and polished, and cleaned with the aid of a solution of nitric acid, diluted with 16 parts of water, which removes all extraneous matters from the surface, especially some traces of copper, which frequently exist in the thin lamina of silver, as has been proved by Mr. Pelouze; this operation requires extreme care in every step; the friction which is applied to assist the action of thé acid, should always be applied in the same line, but not in the same direction; that is, it should be applied backwards and forwards. M. Daguerre has observed that copper plated with silver, produces better results than pure silver, from which it may be inferred, that voltaic action is not foreign to this phenomenon. After this first preparation, the metallic sheet is exposed to the vapour of iodine in a closed vessel, with great and especial precaution; a small quantity of iodine is deposited at the bottom of the vessel, and separated from the metallic plate by a fine gauze which sifts as it were the vapour, and spreads it uniformly; M. Daguerre has also discovered from numerous experiments, a circumstance which science could never have guessed; it is necessary to enclose the plate in a metallic frame, otherwise the iodure will not be condensed in equal quantities throughout the surface, and the whole success of the operation depends upon the perfect uniformity of the surface of iodine of silver which is produced; the plate must be exposed to the vapour of iodine a sufficient time, and no longer, and this instant is indicated by the yellow colour assumed by the plate. M. Dumas having sought to appreciate the thickness of this surface of iodine has shown that it cannot exceed the millionth part of a millimetre! a quantity so amazingly small, that the human mind is as incapable of conceving it, as it is of conceiving the immensity of the heavens, the eternity of time, or the infinity of space. The plate thus prepared, is transferred into the camera obscura, being carefully preserved from the least contact with light; it is, in fact, so extremely sensible, that the tenth part of a second, is sufficient to produce a perceptible impression.

A very simple mechanism allows the plate to be immediately placed in the focus of the camera obscura. The instrument is contained in a cubical box, the sides of which are about two feet. The largest designs hitherto produced are about the size of a quarto page. A plate of ground glass is placed at the focus, so as to ad-

vance or recede, till the image becomes perfectly distinct. The metallic plate is then substituted for the glass, and receives the impression of the image. In a very short time the effect is produced, and the plate may be removed. In this state, the image is scarcely visible: it must undergo another process, which is exposure to the vapour of mercury; and as every thing connected with this truly marvellous phenomenon seems to be enveloped in mystery, the metallic plate will not be properly acted on by the mercurial atmosphere, but at a certain angle. It is enclosed in a box, at the bottom of which is placed a small dish or cup filled with mercury. If the picture is to be viewed in the vertical position, as engravings are usually placed, it must receive the vapour of the mercury at an angle of about 45 degrees; if, on the contrary, it should be desired to view the picture at that angle, it must be exposed horizontally. The emanation from the mercury must be excited by a temperature of 60 degrees Raumur. After these three operations, the mystery is accomplished; it only remains to fix the image, and prevent any farther change from the action of light, or the influence of any other external cause. This is effected by immersion in a solution of hyposulphite of soda. This solution attacks the parts upon which the light has not acted, and is inert on the light parts: it is the contrary with the mercurial vapour, which fixes itself exclusively on those parts on which the luminous rays have fallen; so that it may be conjectured that the light parts are formed by an amalgam of mercury and silver, and the shadows by a sulphur of silver at the expense of the solution of hyposulphite. This is only a conjecture, and consequently may be erroneous. M. Arago, in his own name and in the name of the most learned chemists who have examined the question, declares the incompetence of the combined sciences of physics, chemistry, and optics, to establish a rational and satisfactory theory of these delicate and complicated phenomena. The image resulting from this series of operations, designated by a French writer as "passablement diaboliqué" (sufficiently demonological), undergoes a last ablution in distilled water, after which, it may be exposed to the light, without suffering any farther alteration.

It will naturally be asked if this process, admirable as it is, will not be susceptible of farther improvements; whether, for instance, it will not be possible to produce a picture, not only with the correct proportions and relief of the objects represented, but also with their colours? M. Daguerre is of opinion that this result cannot be obtained, at least with the substance he has employed. Nevertheless, in experimenting on phosphorescence, M. Daguerre has obtained a powder which remains red after having been exposed to red light, and blue after having been exposed to blue light:—who shall say where his discoveries will end, if he perseveres in the path which he has already so far and so triumphantly explored?

Sir John Herschell, in a letter addressed to M. Quetelet, and communicated by him to M. Arago, announces that, by projecting the solar prismatic spectrum upon a sensitive paper, he obtained blue in the place corresponding with the blue rays, and green in the place corresponding with the green rays; but in the place of the red rays, only a slight indication of that colour was observed, at the limit which separates the red from the orange rays.

So much has already been said of the wonderful results of the Daguerre process, that it is scarcely necessary to repeat, that with the exception of colour, it is an absolutely perfect representation of nature; from a deep shade to a brilliant white, including all the intermediate shades, with a perfect delineation of the minutest details, all is produced with a precision which no human hand can approach.

Among the numerous objects to which it may be imagined to apply this invention, one of the most interesting is the production of portraits from life. To accomplish this, the head must remain immoveable during the whole operation. This is a difficulty which may be surmounted by various contrivances; but there is another difficulty which forms a more serious impediment to the production of a perfect portrait: there must be no motion of the features, or winking of the eyes, otherwise the image of those parts will be indistinct; and as it has been found necessary to illuminate the object to be copied with a strong light, it would be impossible for the face, especially the eyes to remain undisturbed during the whole period of the operation.

The problem consists, then, in finding a gentle light, which will act on the iodine, without dazzling the eyes. This problem appears to be already solved, for the light which passes through certain blue glasses, is almost the only part which possesses the discolouring power, and this light is gentle enough to illuminate the face without dazzling the eyes. In conclusion, it may be proper to remark, that the foregoing account differs in some essential

points from the reports which have appeared in different English papers. We have examined those points, and find that our version is correct. In our next we shall offer some further observations on this very prolific subject.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 332.)

WENDOVER is a disfranchised borough and market town, six miles from Tring station. A branch of the Grand Junction Canal extends to this town from near the station, and supplies the inhabitants with coal from Staffordshire. It is a mean looking town, and remarkable for little else than having been represented by the patriot Hampden, to whose family the manor formerly belonged.

IVINGHOE is a market town three miles from Tring station. It is a remarkably small town, surrounded with beautiful scenery. In the church, the following ancient inscription is shown :—" Rauf Folly Wolle, morust le m d'Mai l'an d'gr. M,CCC,XLIX. et Jane sa feme died le vintisme jour de l'an d'gr. M,CCC,LX gisent ici, Dieu de leur Almes fit mercy."

No information of any interest is imparted by this inscription, except to the philological antiquarian, who will recognize in the introduction of the word " died," in the latter sentence, the present English language emerging, even at that early period, from the French, in which the Normans had, as it were, buried the Anglo Saxon. There is a very ancient tomb on the north side of the chancel, which tradition declares to be that of Henry de Blois, Bishop of Winchester, and brother to king Stephen. He was one of the most active and powerful politicians of his day.

DUNSTABLE, a market town in Bedfordshire, is nine miles and a half from Tring station ; it is situated on an eminence near the Chiltern hills, at the intersection of two Roman ways, called Icknield-street, and Watling-street. Like many other towns, it has been severely injured by the falling off of traffic since the formation of the London and Birmingham Railway. The chief resource of the poorer inhabitants, is the manufacture of straw into various articles, especially the far-famed " Dunstable bonnets," which have shaded more lovely faces, than ever smiled beneath an eastern veil. Pillow-lace is also manufactured here, but not so extensively as the straw plait. The surrounding country is celebrated for producing remarkably fine larks, which are sent in great numbers to the London markets. About a mile east of the town, is one of the Chiltern Hills, called Five Knolls, from five Celtic tumuli on its summit. This hill is 800 feet from the level of the sea, and may be seen, on a clear day, from Bardon Hill, in Leicestershire, a distance of nearly eighty miles. It is said, that the first representation of a play in England, took place at Dunstable, under the direction of a priest. Dramatic representations, both in France and in England, were originally confined to Scriptural subjects, and were conducted or encouraged by the priesthood ; profane subjects were afterwards introduced, and ultimately religious subjects were entirely forbidden, and profane performances only tolerated upon condition, that all actors and others employed in the representation, should be excommunicated, which implies a malediction usually expressed by a shorter term. The traces of this stigma are not yet entirely obliterated, and in some countries, even at the present day, players and musicians are refused Christian burial. Dunstable is also renowned for the numerous tournaments which were formerly held there. This exhibition also incurred the displeasure of the church, and Pope Eugenius II. consigned all those who assisted at tournaments, to the keeping of that sable monarch who rules, *sævis unguibus*, the excommunicated. Our ancestors had, however, other motives for abandoning this sport ; it was considered too much for a jest, and too little for earnest ; its extreme folly, and the accidents it frequently occasioned, became so notorious, that it was suppressed in all civilized countries. Notwithstanding the judgment of our forefathers, founded upon long experience, and the diffusion of superior knowledge, which, according to Ovid, should " soften men's manners," an attempt is now making to resuscitate the exploded games, and a number of gentlemen were recently seen at the Stadium at Chelsea, clothed in iron, brass, and tin, mounted on horseback, and running at one another with long spears. But even here, the ascendency of inanimate power, which so remarkably characterizes the present age, was curiously exemplified in the conduct of an automaton knight, composed of wood and metal, moving upon wheels ; he was first put in rapid motion, and then went forward, impelled by the force of his own momentum, upsetting all who attempted to oppose his progress. The

name of the knight is "Dummy;" and considerable sums are said to have been bet on "Dummy against the field." His horse, though inanimate, is a spirited charger, full of mettle and fire,

> "With a cast iron belt, for fear it should melt
> With the heat of the copper colt's belly."

It was a glroious triumph for the admirers of mechanical arts, to behold a doll, a mere pip in the fruit of science, flooring the flowers of fashion, subduing all the valour of Almack's, and snatching sprigs of laurel from vanquished sprigs of nobility;--*lignum vitæ* turned into *lignum mortis*, and the invincible Dummy rolling on like a young Juggernaut over his victims, disdaining even to contemplate the fallen knights who felt and owned his power. It was suggested that Dummy should personate the *inconnu*, or stranger knight, at Eglintonn Castle; but it was decided by a committee of seven sons of *Alma Mater*, who had read, or were supposed to have read, the *Phil. Nat. Prin.*, and other learned books, that Dummy would probably become the final conqueror; and it was deemed a violation of decorum, to suffer a stuffed German stove to salute the lady of the tournament, and her two attendants. It was, therefore, agreed, that the stranger knight should be moved by animal power.

Proceeding from Tring station, the line passes through a cutting two miles and a half in length, and in some parts sixty feet deep; 1,340.464 cubic yards of earth were taken out of it. Emerging from this excavation, an extensive view is obtained; that on the east side of the road is bounded by hills; on the left, near the village, is a very extensive reservoir, containing abundance of fish; and those who prefer Isaac Walton to Isaac Newton, the angle of a fishing-rod to the angles of Euclid, Lea bridge to the *pons assinorum*, and roach, dace, and prickle-backs, to salmon and lobster sauce, may here enjoy "a glorious nibble." The range of chalky hills usually called the Chiltern ridge, which are seen from this place, overlook the Chiltern hundreds of Parliamentary notoriety, the stewardship of which, with an inconsiderable salary, is in the gift of the crown, and reserved for the accommodation of members of Parliament who wish to resign their seats; by accepting this appointment, they become disqualified to retain their seats without a new election, and are thus allowed to retire unmolested from the cares of state, and plant cabbages in emulation of Cincinatus, Peter Steivesant, Joseph de Villèle, Lord Glenelg, and many other great men. At the distance of $40\frac{3}{4}$ miles from London, and $71\frac{1}{2}$ from Birmingham, is

LEIGHTON BUZZARD STATION. The town of Leighton Buzzard, or *Beauderert*, the former being a corruption of the latter, which is the name of the most ancient family in Bedfordshire, on the borders of which county the town is situated. The houses are chiefly ancient, constructed of brick and ribbed with oak, and many of them covered with thatch. In Broad-street is the remains of a monastery, a relic worthy of the inspection of a lover of antiquities. The church is a spacious antique structure, bearing a striking resemblance to that of Ivinghoe, but on a much larger scale. It is 193 feet in height, and forms a prominent object when approached from London by the railway, at a distance of about five miles. There is an ancient Gothic cross in the market place, supposed to be built about 500 years ago. It is of a pentagonal form, having five niches containing figures of saints, &c. in the upper story. The entire height of the cross, including five rows of steps, is 34 feet. It is richly ornamented, and, considering its great age, in excellent preservation. At the north end of the town are alms houses for poor aged persons, founded by Edward Wilkes in 1630. There are several curious inscriptions on these buildings; one of which contains an admonition, so admirable, and so universally applicable, that it deserves to be inscribed at the corner of every street:—"*Let noe brawl nor evil communications be betweene you, but study to be quiet, every one doing his owne business.*" There is a stone coffin, apparently of great antiquity, deposited in the church; many conjectures are hazarded, but its true history is unknown. Near the town are the remains of a Roman camp. From this and other circumstances, it is supposed that Leighton Buzzard is the *Lyg.anburgh* or *Lygeanbury* of the Saxons, taken from the Britons by Cuthwolf.

(To be continued.)

OPTICAL INSTRUMENTS.

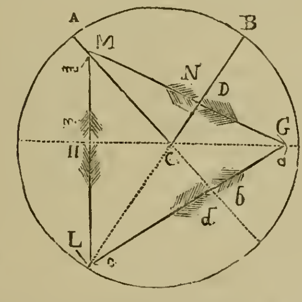
NO. I.

ON PLANE AND CURVED MIRRORS.

ALL the optical instruments now in use have, with the exception of the burning mirrors of Archimedes, been invented by modern philosophers and opticians. In the present papers, I shall confine myself as much as possible to a general account of their construction and properties. One of the simplest optical instruments, is the *single plane* mirror, or looking-glass,

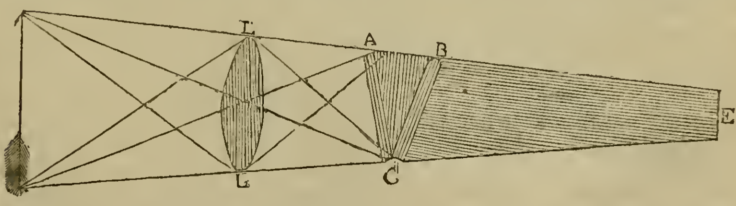
which consists of a plate of glass with parallel surfaces, one of which is covered with tinfoil and quicksilver. The glass performs no other part in this kind of plane mirror, than that of holding and giving a polished surface to the thin bright film of metal, which is extended over it. If the surfaces of the plate of glass are not parallel, we shall have two, three, and four images of all luminous objects seen obliquely; but even when the surfaces are parallel, two images of an object are formed, one reflected from the first surface of glass, and the other from the posterior surface of metal; and the distance of these images will increase with the thickness of the glass. The image reflected from the glass is, however, very faint, compared with the other; so that, for ordinary purposes, a plane glass mirror is sufficiently accurate; but when a plane mirror forms a part of an optical instrument where accuracy of vision is required, it must be made of steel, or silver, or a mixture of copper and tin; and in this case it is called a *speculum*. When two plane mirrors are combined in a particular manner, and placed in a particular position relative to an object, or series of objects, and the eye, they form the *kaleidoscope*, or an instrument for creating and exhibiting beautiful forms. In fig. 1, if A C, B C, be sections of two

Fig. 1.



plane mirrors M N, an object placed between them, or in front of each, the mirror, A C, will form behind it an image, *m n*, of the object, M N. In like manner the mirror, B C, will form an image, D G, behind it. But these images may be considered as new objects, and therefore the mirror, A C, will form behind it an image, H L, of the object, or image D G, and B C will form behind it an image, *a b*, of the object or image, *mn*. In like manner it will be found, that *c d* will be the image of the object, or image, H L, formed by B C, and of the object or image, *a b*, formed by A C. Hence *cd* will actually consist of two images overlapping each other, and forming one, provided the angle A C B is exactly 60°, or the sixth part of a circumference of 360°. In this case all the six images (two of the six forming only one, *cd*) will, along with the original object, M N, form a perfect equilateral triangle. The object, M N, is drawn perpendicular to the mirror, B C, in consequence of which, M N and D G form one straight line; but if M N is moved, all the images will move, and the figure of all the images combined will form another figure of perfect regularity, and exhibiting the most beautiful variations, all of which may be drawn by the methods already described. In reference to the multiplication and arrangement of the images, this is the principle of the kaleidoscope, but the principle of symmetry, which is essential to the instrument, depends on the position of the object and the eye. This will be better understood from fig. 2, where A C E and B C E represent the two mirrors inclined at an angle, A C B, and having C E for their line of junction, or common intersection. If the object is placed at a distance, as at D K, then there is no position of the eye, at or above E, which will give a symmetrical arrangement of the six images shown in fig. 1; for the corresponding parts of the one will never join the corresponding parts of the other. As the object is brought nearer and nearer, the symmetry increases, and is most complete when the object, D K, is quite close to A B C, the ends of the reflectors. But even here it will not be perfect,

Fig. 2.



unless the eye is placed as near as possible to E, the line of junction of the reflectors. The following, therefore, are the three conditions of symmetry in the kaleidos-

cope:—1st. That the reflectors should be placed at an angle which is an *even*, or an *odd* aliquot part of a circle, when the object is regular, and similarly situated with respect to both the mirrors, or an even aliquot part of a circle, when the object is irregular. 2nd. That out of an infinite number of positions for *the object*, both within and without the reflectors, there is only one position where perfect symmetry can be obtained, namely, by placing the object in *contact* with the ends of the reflections, or between them. 3rd. That out of an infinite number of positions for the situation of the eye, there is only one where the symmetry is perfect, namely, as near as possible to the angular point, so that the whole of the circular field can be distinctly seen; and this point is the only one at which the uniformity of the reflected light is greatest. In order to give variety to the figures formed by the instrument, the objects consisting of pieces of coloured glass, &c., are placed in a narrow cell, between two circular pieces of glass, leaving them just room to tumble about, while this cell is turned round. The pictures thus presented to the eye are beyond all description splendid and beautiful, an endless variety of symmetrical combinations presenting themselves to view, and *never again recurring with the same form and colour*. For the purpose of extending the power of the kaleidoscope, and introducing into symmetrical pictures external objects, whether animate or inanimate, Dr. Brewster applied a convex lens (see fig. 2) L D, by means of which an inverted image of a distant object, D K, may be formed at the very extremity of the mirror, and, therefore, brought into a position of greater symmetry, than can be effected in any other way. In this construction, the lens is placed in one tube, and the reflectors in another; so that by pulling out, or pushing in the tube next the eye, the images of objects at any distance can be formed at the place of symmetry. In this way flowers, trees, animals, pictures, &c., may be introduced into symmetrical combinations. When the distance, E B, is less than that at which the eye sees objects distinctly, it is necessary to place a convex lens at E, to give distinct vision of the objects in the picture.

COLONEL PASLEY'S SUB-MARINE EXPERIMENTS AT PORTSMOUTH.

Colonel Pasley's cylinders, ready charged with powder, we believe four in number, having arrived early in the week, accompanied by several of the corps of sappers and miners, it was determined on Thursday to make a trial of their power on the wreck of the *Royal George*; but it being found that the southerly wind threw in too much swell, the attempt was given up; and Friday being a remarkably tranquil day, it was thought nothing would prevent the uninterrupted success of the experiment. Accordingly, at slack water, about half-past one, the cylinder was lowered, and by the report of the diver, was placed outside, and close to the wreck, in about 84 feet water; the Voltaic battery was then applied to the conducting wires, and though there was every evidence that it was in most effective order, still no discharge took place, it being presumed, that in moving such a ponderous body, weighing near 5000lbs., some disconnexion of the wires may have happened. It may be that the smaller, or igniting magazine may have got wetted by the powerful pressure of water, calculated to be equal, at the depth to which the magazine is sunk, to 60 lbs. upon every square inch. The real cause cannot, however, be ascertained, as the hawser by which it was lowered, was carried away in endeavouring to raise it again, it being evidently entangled in some of the timbers of the wreck, though the diver had asserted that it was placed outside, and clear of all. No further attempt will be made to explode the cylinder till the dead of next neap tides, when a longer interval of slack water is afforded; but in the mean time the divers will make an attempt to sling the cylinder again, and ascertain if it can be hauled out from its present situation, and then hoisted up. Colonel Pasley is quite of opinion, that the large bulk of powder is so sufficiently secured, that it is uninjured, and grounds his belief on the fact, that in the Thames, a large body of powder, not half so well protected, remained 60 feet under water for 48 hours uninjured; there are others, however, who surmise, that the protective coating of wood and metal, which encases the present cylinders, is not sufficient to resist the enormous pressure which a depth of nearly fifteen fathoms puts upon it, and the recovery of the cylinder can alone determine the question. It is to be understood, that at the next neaps, about six days hence, another trial will be made, of which public notice will be given. Since the above was written, we understand that Colonel Pasley, accompanied by Mr. Sadler, the able and zealous second master attendant of this dock-yard, who has been indefatigably employed in affording his professional assistance in this undertak-

ing, proceeded this afternoon to Spithead, and in order to prove the correctness of his system, caused two canisters, each containing 45 lbs. of powder, to be lowered near to the wreck of the *Royal George*, in fifteen fathoms of water, one of which was exploded by the Voltaic battery. the other by Beckford's fuse; in the former case, the explosion was instantaneous, in the latter, two minutes. Both experiments were perfectly successful, and as the operation was precisely that intended to explode the large cylinder, it is clearly shown that the failure of yesterday cannot be attributed to any fault in Colonel Pasley's system. The explosions produced no commotion, only a smoothness in the water, immediately followed by a black cloud of mud spreading on the surface to the extent of many feet. They were, however, felt on board her Majesty's ship *Blenheim*.—*Hampshire Telegraph.*

HYBERNATION OF SWALLOWS.

To the Editor of the Mechanic and Chemist.

Sir,—In reference to an article in your Number for Aug. 17th, on the migration of birds, permit me to state, that I never had the least doubt of the remarkable mode of hybernation of some of the few straggling swallows, who are not able to accompany the majority in their annual flight to warmer regions.

The reason of my firm belief and certainty of the fact, that some swallows do seek their winter abode in the mud or soft earth at the bottom of shallow waters, and surprise at so much doubt existing as to the truth of such accounts, is this:—When about seven years of age, in company with several other boys, all belonging to a boarding school at Hartfield, in Sussex, we were passing by a small pond, in company with a country lad of about sixteen years of age, who stopped and pointed out to us a solitary swallow, flitting over the centre of the pond in what appeared to us an unusual manner. "Now mind," said the lad, "you'll soon see him dive into the water, and there remain." We all laughed at him, but watched the bird; and sure enough he did plunge into the water like a stone, having previously gained a sufficient height from its surface to enable him so to do. We looked on for some time, till the undulations caused by the splash had disappeared, but no signs of the swallow again emerging appeared. "Now," said the lad, "I'll go and fetch him out;" so, taking off his coat, shoes, and stockings, and turning up his shirt's sleeves, he walked into the middle of the pond, and after a very short search (for it seems he had marked the spot well), he succeeded in raising the apparently inanimate bird from his intended winter bed. Most of us were rather surprised at these sayings and doings, and surveyed the youth and the bird in his hand with no little wonder and astonishment. He then washed off the mud, and after a little time the swallow came to be visibly alive, looked about him with great curiosity, and shortly after took to flight. From the foregoing statement it appears, that the fact of swallows occasionally diving, as just related, for shelter during the winter storms and cold, could not be of very rare occurrence, or why should so young a person be so well enabled to foretel, from the manner of the bird's flight, that it would eventually seek for refuge beneath the water?

I remain yours, &c.,

J. B.

SOUTH AUSTRALIA.

The following letter we extract from the *South Australian Record*, a paper we have before recommended to the notice of those who contemplate emigration to that country, or are otherwise interested in the affairs of our brothers at the antipodes It contains an amount of useful and various information, beyond comparison superior to any other journal published in this country. This letter contains internal testimony of its genuiness, and we think the reader may safely rely upon the correctness of its statements:—

Letter from Edmund James Constable, labourer, who emigrated from Boxley, Kent, to his Father at Boxley.

Adelaide, December 23, 1838.

Dear mother and father, relations and friends,—I have at last sat down to write to you. The first thing I must ask is, to excuse me for not writing before, but it is not my neglect, but I wished to get all the information I could possibly obtain. I believe the last promise I made to you was to write the truth, and I now intend it. I am very sorry to tell you that I have lost both my dear little boys. John died at sea, cutting his teeth, on the 26th of August, in latitude 37° 39′ north, longitude 37° 35′ east; and my dear Edward died suddenly on the 12th December. I had him buried very decently. I must now tell you some of the particulars of our voyage. We sailed from Gravesend on the 11th of June, passing Sheerness at day-

break. I looked at the town, thinking of my dear sister, who was sleeping in bed, little thinking that I was passing so near. We passed Dover about noon, when we began to spread our canvass, looking forward at the wide expanse that lay before us; and next morning we had lost sight of old England, looking forward for a better country, in which we are not deceived. In fourteen days we got to the Bay of Biscay, eighteen to Madeira, and 28 to St. Jago, one of the Cape de Verd Islands. We put in here for water, and bought oranges, lemons, bananas, tamarinds, pines, eggs, and tobacco, all very cheap. We crossed the line in six weeks, and reached this port on the 15th of September, making our passage in ninety-six days. We came up the river on a Sunday morning as the sun was rising, with a gentle breeze on our starboard quarter. It seemed so pleasant to see the beautiful mangrove trees, something like laurels, on each side of the smooth water. It was a treat, after being eight days under close-reefed topsails. We landed on the 17th, and was received by an officer who took care of our goods, and provided carts to convey them to the town. We went to a place called Emigrant Square, a place on purpose, consisting of thirty-four wooden houses brought from London. We are allowed to live in them three months, and fourteen days' provisions. To save room, I can tell you that everything I read to you concerning this beautiful country is true. I agreed on Thursday week with another master; my wife and I are to have 64*l.* a year, board, washing, and lodging. We are living under Colonel Wyndham; he has got one thousand acres of land. We like our situation very well, and if we cannot save money now, when can we? I expect by the time you receive this, I shall have twenty acres of land. I am going to-morrow to see about it. My work is generally carpentering. I have just completed a large cow-yard, and I am now gowing to build a kitchen and two bed-rooms. Master has got one of Manning's wooden houses; we have a room in it to ourselves. We have two men servants besides. We live in a beautiful valley about six miles from town. Friend Cleggett and Stanley Hook (two labourers from Boxley) have been working for 12s. a day ever since they landed; they did not arrive till fourteen days after us. All my friends that sailed before me arrived safe. I would not advise any one to engage before they get here; it has been 12*l.* out of my way. My dear wife says she was never so well off in her life. I am very glad to see her happy, as she is the only companion I have, now I have lost my little prattlers. I have been to stringy Bark Forest, five miles over the mountains; to Outcaparingo, fifteen miles west of the town; and to Holdfast Bay. I am going with my master to town to morrow for a holiday being Christmas eve, when I shall put this into the post and a newspaper. I dare say it is a dull Christmas with you. It grieves me to see masters wanting men at such good wages, when at the same time there is many a good fellow in England starving through the want of employment. I should like to see my brothers, Edward, William, and Francis, landed on this shore. I am certain William would soon make his fortune. Dear brothers, believe this from your ever faithful brother and friend, that if you knew as much as I do about it you would not hesitate one moment, but you would sell the last shirt on your back to come. I would not be placed in England again for 30C*l.* I think my brother William would have his health better here; it is now midsummer, and I have known the heat to be more oppressive in England than it is here. There is always a refreshing breeze. Here are some of the most beautiful birds I ever saw; there is, I think, twelve varieties of parrot, from the size of the sparrow to that of the duck. Cattle are getting very plentiful here; they are driven over the land from Sydney—1,200 miles—in about four months. Dear friends, my paper begins to grow short; I will ask you one favour—to let any one see this letter that likes to read it, as I shall not be afraid you [they] will call me a liar when you [they] come. Dear parents, I must now conclude by sending our kind love to you and wishing you well. We remain your ever dutiful son and daughter.

EDMUND JAMES AND DEBORAH CONSTABLE.

PHYSICAL CHANGES OF THE GLOBE.

THE globe, in the first state in which the imagination can venture to consider it, says Sir H. Davy, appears to have been a fluid mass, with an immense atmosphere revolving in space round the sun. By its cooling, a portion of its atmosphere was probably condensed into water, which occupied a part of its surface. In this state no forms of life, sech as now belong to our system, could have inhabited it. The crystalline rocks, or, as they are called by

geologists, the primary rocks, which contain no vestiges of a former order of things, were the results of the first consolidation on its surface. Upon the farther cooling, the water, which, more or less, had covered it, contracted; depositions took place; shell-fish and coral insects were created, and began their labours. Islands appeared in the midst of the ocean, raised from the deep by the productive energies of millions of zoophytes. These islands became covered with vegetables fitted to bear a high temperature, such as palms, and various species of plants, similar to those which now exist in the hottest parts of the world. The submarine rocks of these new formations of land became covered with aquatic vegetables, on which various species of shell-fish, and common fishès, found their nourishment. As the temperature of the globe became lower, species of the oviparous reptiles appear to have been created to inhabit it; and the turtle, crocodile, and various gigantic animals of the Sauri (lizard) kind, seem to have haunted the bays and waters of the primitive lands. But in this state of things, there appears to have been no order of events similar to the present. Immense volcanic explosions seem to have taken place, accompanied by elevations and depressions of the surface of the globe, producing mountains, and causing new and extensive depositions from the primitive ocean. The remains of living beings, plants, fishes, birds, and oviparous reptiles, are found in the strata of rocks which are the monuments and evidence of these changes. When these revolutions became less frequent, and the globe became still more cooled, and inequalities of temperature were established by means of the mountain chains, more perfect animals became its inhabitants, such as the mammoth, megalonix, megatherium, and gigantic hyena, many of which have become extinct. Five successive races of plants, and four successive races of animals, appear to have been created and swept away by the physical revolutions of the globe, before the system of things became so permanent as to fit the world for man. In none of these formations, whether called secondary, tertiary, or diluvial, have the fossil remains of man, or any of his works, been discovered. At last, man was created, and since that period there has been little alteration in the physical circumstances of the globe.—*Coombe's Lectures.*

THE CHEMIST.

GALNANISM.

(*Continued from page* 318.)

(See engraving, front page.)

25. The instrument constructed in this manner will afford a perpetual current of electricity through any conductor connecting the upper and lower plates. If the pile be of sufficient extent (say forty pairs), and the bands being moistened with water and applied to the plates, a shock will be felt each time the contact is made. It is shown at Fig. 1.

26. Fig. 2 represents another form of the battery; it was called by Volta the "couronne de tasses." It consists of a row of glasses or cups, containing any oxydating fluid; into each of these is placed a piece of zinc and a piece of copper; these plates are made to communicate with each other by means of a wire, so that the zinc of one glass is joined to the copper of the other, and so on. Though this machine will continue in action a long time, yet where one of considerable power is required, it occupies a great deal of room.

27. The battery represented at fig. 3, is much more convenient and powerful than the two last described. It consists of a trough of baked wood, about three inches deep, and about as broad. In the sides of this vessel are grooves, opposite each other, and about a quarter of an inch apart. Into each pair of these opposite grooves, is placed a plate of zinc and copper soldered together; these plates are well fixed in the grooves in the proper order of zinc and copper, as in the pile, by means of a cement made of five parts of resin, four of bees-wax, and two of plaster of Paris. This cement must be run in very carefully, so as to prevent any communication between the different cells; the edges of the plates must also be wiped dry. The cells are then filled with water, containing a little acid or common salt. This battery is the invention of Mr. Cruickshanks.

28. There is also another method of fitting up a trough battery, as shown at fig. 4. A, is a trough made of earthenware, having partitions of the same material, and the metallic plates are attached by screws and nuts to a bar of wood, B, that they may be immersed and removed at one operation. These troughs are filled with dilute acid, and by uniting them in regular order, the apparatus may be enlarged to any required extent. It is on this principle that the great apparatus of the Royal Institution is constructed.

29. It was observed by Dr. Wollaston, that by exposing both sides of the zinc plate to the action of the copper, that the power is greatly augmented. It has been found possible to produce the more energetic effects of galvanism, by a very small battery of this kind. The inventor of the apparatus just described, found that a plate of zinc of the size of a square inch, when properly mounted in the manner above described between two plates of copper, of the same size, and suspended in dilute acid, was more than sufficient to ignite a platina wire one three-thousandth of an inch in diameter, which formed part of the connexion between the two metals. Fig. 5 is a representation of this kind of battery. The dark plates are the zinc, and the light the copper.

30. The first large battery of the simple kind above described, was made by Dr. Hare, of Philadelphia, and called by him a "caliometer," from its remarkable power of producing heat. The dark line the zinc, and the light the copper.

31. Mr. Hart, of Glasgow, invented another battery of this kind, in which the cells were formed of copper plates. A piece of copper was formed into a square cell, and soldered so as to retain the liquid when put in them, and the zinc plates are suspended in the cells by means of nuts and screws uniting them to a bar of wood.

32. These several arrangements are now in a great measure suspended by the recent improvement of Professor Daniell, of King's College, in the construction of the apparatus to which he has given the name of the sustaining battery. In the previous forms of the Voltaic battery, dilute acid were used as the exciting fluids; but much inconvenience was the consequence, as the strength of the acid gradually diminished with the length of time the battery was kept in action, and also the formation of oxide on the surface of the zinc plate, thereby impeding the direction of the remaining acid, together with the escape of hydrogen gas, resulting from the decomposition of the water, and the precipitation of metallic zinc on the copper plates.

33. These several impediments, acting in opposition to the development of the full effects of the battery, tended much to diminish the utility of the apparatus. Little dependence could be placed on its action after being immersed in the acid for a short time, and when an extensive series were employed, it amounted to a serious inconvenience, as the plates first immersed were sinking gradually in action before the last set of plates could be excited.

34. Mr. Warren de la Rue has endeavoured to remedy these defects, by employing a saturated solution of sulphate of copper, slightly acidulated with nitric acid, by which means the action is kept up for several hours.

35. This gentleman considers, that the evolutions of hydrogen gas carries with it a considerable portion of the electricity developed by the battery, and that also the heat evolved by the chemical action, produces an evaporation of the fluid contents of the battery, and the vapour formed carrying with it (as in the case of the hydrogen) a portion of electricity.

36. These several objections are almost, if not entirely, obviated by the invention of Professor Daniell.

37. It appears he was led to the construction of this arrangement, from his observations of the two following points: 1st. As regards the action of the evolved hydrogen; 2nd. That of the relative surface of the zinc and copper forming the plates of the battery, the action of the nascent hydrogen be found to consist in its tendency to deoxidize the oxide of zinc formed during the chemical action of the acid upon the latter, the revived metal being deposited upon the negative plate, or copper surface of the battery.

38. The continued deposition of zinc on the copper surface, diminished successively the action of the battery, in proportion as the copper became coated, it therefore became necessary to obviate the injurious tendency resulting from this action. This was in some measure effected by adding nitric acid to the usual charge of the battery, its action being to dissolve the metallic zinc deposited on the copper; this, however, it appears, was not sufficient, and he found that, if the hydrogen was removed by causing it to deoxidize a metallic solution, the metal precipitated from which should not interfere with the action of the negative surface, that great increase of power was obtained, together with a steady and continued action. 3rd. As to the importance of an increase of size in the copper surface over that of the zinc, the latter, he found, might be reduced to a mere rod, without any diminution in the effect. The result of these observations led to the construction of his sustaining battery.

39. It consists of a cylindrical vessel of copper, having a membrane (as the gullet of an ox passing through the centre), the latter terminating in a glass syphon without the cylinder, in the inside of which is

suspended a rod of zinc. In order to excite this battery, dilute acid is poured into the membrane, and outside of the latter a solution of the sulphate of copper.

40. The battery now about to be described, is a modification of that first proposed by the above professor. It consists of a scroll of thin sheet copper, open at both ends; a sheet of stout zinc is then coiled up in a similar manner, each scroll being furnished with a piece of copper wire, to act as poles or *electrodes*; a thin bladder is tied loosely round the copper, leaving it open at the top, and the construction of the battery is completed. In order to excite it, place it in a small jelly-pot; pour inside the copper cylinder a saturated solution of sulphate of copper, which is of course retained in its position by the surrounding membrane, and outside the latter, and in contact with the zinc, a solution of common salt in water. The battery is then ready for action, and will retain its activity for several days.

41. When a galvanic battery of the first order (the action of those of the second being weaker (consists of twenty repetitions of simple combinations; if you touch with one hand one extremity of the battery, and apply your other hand to the other extremity, a very slight shock will be felt, like that which is communicated by a Leyden phial weakly charged, and it will be scarcely felt beyond the fingers. This shock is felt as often as you renew the contact.

42. The intensity of the charge, is, however, so low, that it cannot make its way through the dry skin of the hand, which is but an imperfect conductor; the fingers should therefore be moistened with water.

43. The galvanic shock is similar to that of an electrical battery, weakly charged, and not like a small Leyden phial, full charged. The difference appears to consist in this, that the latter contains a small quantity of the electric fluid much condensed, so that it can force its way through a certain distance, perhaps an inch of air; but the former contains a vast quantity of the electric fluid in a very rare state; it cannot, therefore, force a passage through the air, and the substances that form the communication must come into actual contact, or very nearly so.

44. If a wire, proceeding from one extremity of a strong galvanic battery, be made to communicate with the inside coating of a common Leyden jar, or electrical battery, and a wire proceeding from the other extremity, be made to communicate with the outside coating, the jar will become almost instantaneously charged in the same manner as by the common electrical machine.

Comparative Purity of Salt.—From the experiments of Dr. Henry, of Manchester, made some years ago in order to ascertain the respective purity of salt, it appears that that called the fishery salt, produced in Cheshire, contains 986¾ parts of pure muriate of soda in 1000, the remaining 13¼ parts being chiefly sulphate of lime. The salt formed by simply crushing the rock of the Cheshire mines, is little inferior in purity, being 983¼ parts of muriate of soda to 6¼ of sulphate of lime, 10 of insoluble earthy matter, and various minute proportions of muriates and sulphates. The Scotch common salt was found to have only 935¼ of pure muriate of soda or genuine salt, to 28 muriate of magnesia, 4 of earthy matter, 15 sulphate of lime, and 17¾ sulphate of magnesia. The French salt varies in purity between the common Scotch, and the Cheshire kinds. It was calculated by M. Necker, that the people of France annually consumed 19½ pounds of salt each at an average. Mr. M'Culloch calculates, that those of Great Britain consume each 22 pounds, and assigns the differenee in the chief aliments of the two countries as the cause why the Englishman eats two pounds and a half more than his neighbour on the other side of the Channel. Satt is raised for various purposes; it is employed in glass-making, in the operations of the skinner, in the manufacture of bleaching liquor, in making the glaze for earthenware, in the preparation of extensively used medicines, and to a considerable extent in agriculture, an idea suggested by Napier upwards of two centuries ago.

P. Truman.

Animalcules have been discovered, whose magnitude is such, that a million of them does not exceed the bulk of a grain of sand; and yet each of these creatures is composed of members as curiously organized as those of the largest species; they have life and spontaneous motion, and are endued with sense and instinct. In the liquids in which they live, they are observed to move with astonishing speed and activity; nor are their motions blind and fortuitous, but evidently governed by choice, and directed to an end. They use food and drink, from which they derive nutrition, and are therefore furnished with a digestive apparatus. They have great muscular power, and are furnished with limbs and muscles of strength and flexibility. They are susceptible of the same appetites, and obnoxious to the same passions, the gratification of which is attended with the same results as in our own species. Spallanzani observes, that certain animalcules devour others so voraciously, that they fatten and become indolent and sluggish by overfeeding. After a meal of this kind, if they be confined in distilled water, so as to be deprived of all food, their condition becomes reduced; they regain their spirit and activity, and amuse themselves in the pursuit of the more minute animals which are supplied to them; they swallow these without depriving them of life, for by the aid of the microscope, the one has been observed moving within the body of the other.

A New Method of Securing Property from Fire.—The most effectual plan, out of the many contrivances for preserving papers and other valuables from the destructive ravages of fire, has been by sinking a well about fifteen feet deep, and lowering the property into it, and then securing the top with an iron door. This plan, however, has been but little adopted, in consequence of the enormous expense required for the requisite machinery,—the great manual labour required,—and the frequent repairs which are found to be necessary. Our attention has been called to a novel and ingenious apparatus for this purpose, which has just been patented by Mr. Chubb, the lock inventor, and which seems to obviate all the defects of former machines. It appears that one man can raise or lower an iorn safe of two tons weight into a well fifteen feet deep, in the space of five minutes. We have seen a model of the machine, and were struck with its great simplicity and security. The invention must, we think, be indispensable to bankers, as it also gives perfect safety from burglars, the door at the top having a lock to throw bolts all round. —*Manchester Guardian.*

Victoria Level—The promoters of the magnificent undertaking of reclaiming from the ocean and bringing into cultivation upwards of 150,000 acres of fertile land, are making considerable progress. Another meeting was held at the Fen Office, in Serjeant's Inn, on Tuesday se'nnight, Lord George Bentinck, M.P., in the chair, when a communication was made, that her Majesty's government had relinquished upon terms all the rights of the Crown to the land intended to be recovered. A variety of reports were read from several scientific and other persons well acquainted with the subject, all confirmatory of the opinion of the promoters as to the practicability and profit as to the proposed undertaking; of which 4,000 acres valued at £40. per acre, would be brought into cultivation in the short space of four years; and 73,000 acres are already land at the receding of the tide. When we consider the vast field of enterprise, industry, and wealth which will arise to all classes of her Majesty's subjects, without expatriation or severance of any domestic ties, we cannot doubt that a general feeling of support will be given to attain the accomplished end.—*Cambridge Chronicle.*

Cloth-making without Spinning or Weaving.—Among the many extraordinary and truly wonderful inventions of the present times, is a machine for the making of broad or narrow wollen cloths without spinning or weaving and, from our acquaintance with the staple manufacturer of this district, after an inspection of patterns of this cloth, we should say there is every probability of this fabric superseding the usual mode of making cloth by spinning and weaving. The machines are patented in this and every other manufacturing nation. The inventor is an American, and appears to have a certain prospect of realizing an ample fortune by the sale of his patent right. We understand patterns of this cloth, as well as a drawing of the machinery, have been shown to many of our principal merchants and manufacturers, none of whom have expressed a doubt but that the machine appears capable of making low cloths which require a good substance. Should it succeed to anything near the expectation of the patentees, its abridgment of labour, as well manual as by machinery, will be very great. We find that means are already taken to introduce this machine among our contental rivals; a company of eleven gentlemen in London have deposited five thousand pounds with the patentees, who have ordered a machine for them; when finished they are to try it for one month, and if at the end of that time they think it will succeed, they are to pay twenty thousand pounds for the patent right in the kingdom of Belgium, and it will of course be worked there. We are therefore bound in duty to our country, and her manufacturing interests, to adopt such facilities as will prevent us falling into a position below our rivals in other countries. We are informed the necessary machinery for the production of this patent woollen felted cloth will be tried here in a week or two, under the superintendence of the inventor, by a cloth merchant who has an exclusive licence, but is about to associate with him twenty other respectable business men, for the purpose of sharing the expenses of giving the invention a fair trial. It is calculated that one set of machinery, not costing more than six hundred pounds, will be capable of producing six hundred yards of woollen cloth, thirty-six inches in width, per day of twelve hours.—*Leeds Mercury.*

Self-taught Sculptors.—There is now exhibiting in Bold-street, Liverpool, a group of sculpture by a self-taught artist, of the name of John Currie, a native of Dumfries. It is very admirably executed on free-stone—the size of life—and represents " Old Mortality " renewing the inscriptions on the grave-stones of the Covenanters, as described by Sir Walter Scott. By his side stands his aged pony. The venerable old man is leaning full-length on the stone, looking up and resting from his labour. The artist has very skilfully given the character of wood and iron to the mallet and chisel. By the way, the son of " Old Mortality," Robert Paterson, is now living, at the age of seventy, and following the trade of shoe-maker, at Balmacklannon, near Castle-Douglas—his father having pursued his favourite but unprofitable calling during a period of more than thirty years of his life. Mr. Currie is now engaged on another group, representing " Edie Ochiltree and Dousterswivel ;" and it is his intention to exhibit them both in London. They are somewhat similar in style and character to the Tam and Souter Johnny of Mr. Thom, which a few years ago attracted so much attention, and which are now at Ayr. Mr. Thom is at present residing at New York. Greenshields, whose " Jolly Beggars " obtained so much celebrity, is dead. Mr. Cadell, of St. Andrew's Square, possesses his seated figure of Sir Walter Scott, from life. Forrest, another self-taught artist of Scotland, has now an exhibition open on the Calton Hill. Mr. Currie will, no doubt, rival the most successful of his countrymen.—*From the Art-Union.*

Insect Ingenuity.—Almost all animals come into the world covered with clothing adapted to their condition. Man is an exception, because

he can clothe himself. He is not, however, the only exception; nor is he the only animal that can clothe itself. The larva or grub of that species of moth which is called the "clothes moth," manufactures, as soon as it comes into the world a coat for itself, of hair or wool, and for the protection of its tender skin, lines it with silk, which, as if it had learnt the art of tailoring, it accomplishes with ease. It begins, as an experienced workman would do, by making two slits, one on each side, in order to give additional width, and then it introduces two slips of the same materials to fill up the space; but it sees, or it acts as if it foresaw, that if the slits were made on each side, from one end to the other, at once the coat would fall off; it proceeds, therefore, with caution, and it first slits the garment on each side only half way down, and when it has completed the enlargement of that half, proceeds in like manner to enlarge the other. What more could be done by a skilful tailor? And, be it observed, that this operation is performed, not by imitation, for it never saw the thing done; nor by practice, for it is its first attempt —*Crombie's Nat. Theology.*

The Boomarang.—Curious Coincidence.—The boomarang, a weapon of the chase, lately introduced into England from New Holland, and considered a new and singular curiosity, was well-known to the ancient Egyptians. In the library of the United Service Institution, on the same shelf and side by side, is Major Sir Thomas Mitchell's book on his discoveries in Austrailia, and Mr. Wilkinson's description of the manners and customs of the ancient Egyptians. In each of these works (page 133, vol. 2 of the former and page 39, vol. 3, of the latter) a native of either country is represented throwing his boomarang among a flock of wild water fowls, and this without either author being aware of what the other was describing. Thus more than two thousand years have elapsed since the period when the Egyptian artist represented his countrymen boomaranging wild fowls on the waters of the Nile; and Major Sir Thomas Mitchell depicted a savage of Australia similarily occupied on the banks of the Murray, which river may be called the Nile of Australia—*Cork Standard*

Tortoise Shell.—The *usual* way to extract the bones and flesh of the tortoise from its shell, is to separate the convex from the flat surface. These are properly connected afterwards by wire. The writer had a land tortoise, which dying, was taken to a preserver of animals. He positively asserted, that the above was the only method for extricating the bones and flesh of the animal. A friend of the writer fancied that it was not, and, after various conjectures, hit upon an expedient which fully succeeded, and that too, with no exertion nor expense on his part. He placed it in an out-house for the large flies to deposit their eggs in it. The eggs grew to maggots, and the maggots consumed every ligament and particle of flesh. In a few weeks after it was first put there, every bone dropped out, and all that remained was, to wash it thoroughly, and place it for some time in the open air, to cleanse it from the effluvia necessarily arising therefrom.

PROPORTIO.

Awkward Railroad Affair.—A few days ago a happy couple, members of two highly respectable families in the neighbourhood, were joined in wedlock, at the old church, Wandsworth, and the bride and bridegroom having fixed on Southampton as the place for spending the "honey moon," carriages were in attendance to convey them and their friends to the nearest station on the Southampton line of railway as soon as the ceremony was concluded. On the arrival of the train at the station, the bride was placed in one of the first-rate carriages, and the luggage deposited in a proper place of security, but while the bridegroom (M.D.) was taking-leave of a number of friends who had accompanied him to the spot, the conductor gave the word "all right, go on," the engineer turned on the steam, and in an instant the train shot off at so rapid a rate as to be out of sight. The feeling of the gentleman on being deprived of his bride so soon, may be more easily conceived than described. The emergency seemed naturally to perplex him much, but he at length determined on "posting" it to Southampton, and four horses were at once put to one of the carriages, and the vehicle was driven off at a pace little short of railroad speed.

Water-Spout at Brighton.—At about nine o'clock on Monday morning, a water-spout was observed about ten miles to the south west of this town. The weather was cloudy, and there was a light breeze from the north-west. When first seen, it had the appearance of a pillar suspended from a black cloud to about one-third of the distance between the cloud and the sea. Five minutes afterwards, it began gradually to descend till it met the water, when the sea was observed through the telescope to be in a state of great agitation. The spout was less dense at the bottom than at the top, and in the middle it appeared to be considerably more attenuated than at the outside. In a few minutes the watery column was again gradually drawn into the cloud, and disappeared, the cloud having in the mean time been driven by the wind towards the south-east. A considerable number of persons were witnesses from the cliffs, of the water-spout, which is the only one that has been seen in Brighton for a period of, we understand, ten or twelve years.—*Brighton Gazette.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Aug. 4, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Sept. 5, G. F. Richardson, Esq., on Geology. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Sept. 3, E. Dowling, Esq., on Logic. At a quarter to nine.

QUERIES.

Where can asphalt be bought, the cheapest, and what is the price of it per hundred weight.

A CONSTANT READER.

The best method of staining iron black, and also a good receipt for varnish generally used for wood? W. M.

I have one of Carpentar's Lucernal Microscopes attached to a Phantasmagoria Lantern; can you or any of your intelligent correspondents inform me how I can obtain a more brilliant and powerful light than that produced by an oil lamp? I mean the Argaud lamp. The oxy-hydrogen light is not produced without so much apparatus, and also expense, that I feel confident some of your numerous readers are in possession of the required information. I wish to purchase Cooper's parlour printing press; if any of the readers of the "Mechanic" are in possession of it, and wish to sell it at a moderate price, by stating the price and when I can see it, they will oblige

GULLILMUS.

[A simple process and apparatus for the production of the oxyhydrogen light, is an object much desired, and is a fit subject for the meditation of the ingenious. It should combine these qualities—safety, convenience, and economy. The naptha lamp gives a more powerful light than oil; but it is objectionable, on account of the unpleasant odour which emanates from the combustible.—ED]

1. Determine the length of the chord that will cut off one-third of the area of a given circle? 2. How to preserve written labels of bottles containing acids? I have tried copal varnish, but it does not succeed. 3. How to set about to analyze anything? 4. To describe a cheap and simple method of making a Leyden jar or phial? I have tried putting a nail through the cork of a phial containing water; it succeeded for a short time in collecting the electric fluid, but after a little use, it let the fluid escape as fast as it got in.

Chatham. T. S. J.

ANSWER TO QUERY.

I am very sorry to hear from "A Constant Purchaser," that the receipt which I sent for removing superfluous hair has failed; it was an extract from a work published by an eminent physician some years back, and is worded precisely the same as in the book; but I send the following, which is called "an approved deplicatory fluid," but, like the foregoing receipt, I cannot answer for its being effectual, as I have never had occasion to try it:—Take polypody of the oak, cut into very small pieces; put them into a glass cucurbit (an oblong vessel); pour thereon as much Lisbon, or French white wine, as will rise about an inch above the ingredients, and digest in balneo mariae (or a bath of hot water) for twenty-four hours; then distill off the liquor by the heat of the boiling water, till the whole has come over the helm. A linen cloth wetted with this fluid, may be applied to the forehead, back of the hand, or any other part, and kept thereon all night. This application must be repeated every night till the hair fall off. The distilled water of the leaves and roots of celandine, applied in the same manner has the same effect.

W. G. A. H,

TO CORRESPONDENTS.

H. P. *will find the information he desires in the first or second article on the Birmingham Railway in the "Mechanic," a few numbers back.*

J. S. J.—*The best method of drying precipitates of the delicate and sensitive nature he describes, is under the exhausted receiver of an air-pump, by which means they are protected from contact with oxygen, and the evaporation is facilitated by the vacuum. To produce the crystals he requires, the solution must not be evaporated till the water entirely disappears, but left to cool when the liquid is saturated, and the salt will be deposited in crystals.*

Lixiviate *is salt obtained from the ashes of burnt vegetable matter; potash.*

Limpid *signifies bright and clear; as pure water, which is perfectly* limpid.

Plumose *signifies* feathery.

Hepatic—*relating to the liver; disease of the liver. His other queries will be inserted, as they may elicit some interesting communications from our scientific correspondents.*

W. C.—*When a body is put in motion in any direction, it will continue to move forward in a straight line till it is diverted therefrom by some external force, or till its momentum is expended on external impediments. When a stone is projected horizontally on the surface of a smooth sheet of ice, its progress is opposed by the resistance of the air, and the friction of its contact with the ice; and if it rebound, a portion of its motion is also lost by being exerted in the perpendicular direction. If, instead of passing over ice, it were to be thrown or bowled over a surface less smooth and equal, the resistance would be proportionally greater, and its motion would be sooner expended; and if it were projected from an eminence, where it would meet with no other obstacle than the resistance of the air, it would be conveyed to a much greater horizontal distance than in either of the foregoing cases. His notion that the contact of the ice will accelerate a body's motion, is very absurd indeed. When a body is in motion, it cannot touch any other body at rest, without communicating some impulse to that body, and suffering a loss in its own motion, proportional to the inertia of the obstacle, and the direction of the impact.*

ERRATUM.—In page 317, line 2 from the bottom, for "electroites" read *electrodes.*

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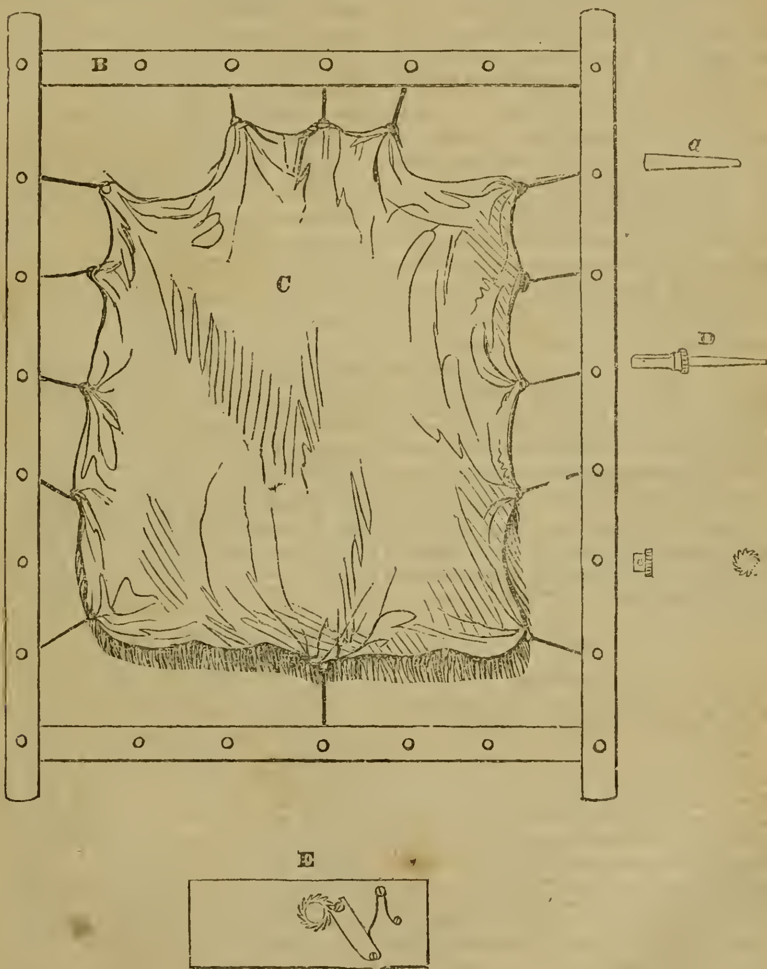
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XLV. NEW SERIES. | SATURDAY, SEPT. 7, 1839. PRICE ONE PENNY. | No. CLXVI. OLD SERIES.

WALTER'S IMPROVED APPARATUS FOR PREPARING SKINS.



City Press, 1. Long Lane, Aldersgate Street: D. A. Doudney.

WALTER'S IMPROVED APPARATUS FOR PREPARING SKINS.

To the Editor of the Mechanic and Chemist.

SIR,—I have taken the opportunity of sending you a sketch and a model in part of a plan which will perhaps be useful to some of your readers; if you will be kind enough to insert them in your useful magazine, I shall be much obliged.

In witnessing the inconvenience arising from the old method of manufacturing Lapland mats from sheeps' skins, I was led to propose the following improvement, namely, that that part of the business consisting of the frames only, and which is applicable also to parchment for making frames for fellmongers, &c.

EXPLANATION.—Fig. 1, A is one of the pegs, B is the frame, and C is the skin ready for dressing. This is the usual mode of stretching the skin intended for the mat, which requires to be wedged in as soon as the skin is sufficiently spread open, but the uncertainty of their keeping their position renders them very troublesome. So soon as the dressing commences, the pegs, more or less of them, loosen, and occasion a deal of trouble; it is obvious, then, that the ferrel, fig. 2, D, and fig. 3, E, with a latch and spring, would prevent their giving way, and be a source of other advantages. The latch and ferrel can be of cast iron, screwed together with a spring, which may be obtained at a trifling cost, and can also be applied to those now in use. I remain yours, &c.

S. WALTER.

[This simple invention will doubtless facilitate the operations to which it is intended to be applied; a model may be seen by application at "The Mechanic" office.—ED.]

PHOTOGENY.

Further Particulars of the Daguerre Process, and an Improvement by M. Dumas.

SINCE the publication of our last No., we have received from Paris some new details of this process, which were omitted by M. Arago at the memorable sitting of the 19th of August, but which he has since made known in reproducing his report in writing. Although some portions of the following extracts (from the communication of August 26) may be regarded as repetitions, the important development and practical hints which they contain, will, we conceive, be a sufficient apology, and they will be read with interest by all who are disposed to study the photogenic art.

In the process of M. Daguerre, the plated metal, which is used as the canvas of the picture, is placed horizontally, with the silver downwards, in a box, at the bottom of which are deposited small portions of iodine, left to *spontaneous evaporation*. In a short time the silver assumes a golden yellow colour. When this plate is removed from the camera obscura, there is no visible trace of the action of light; the yellow surface of iodure of silver, which receives the image, retains a *perfectly uniform* tint throughout its whole extent. When the plate is exposed in a second box, to an ascending current of the vapour of mercury, rising from a vessel in which the metal is raised to the temperature of 75° (centigrade) by the action of a spirit lamp, a most curious and surprising effect is produced. The mercury attaches itself in abundance to the parts which have been acted on by a strong light; it leaves untouched the parts which have remained in the shade; and, lastly, it creeps over the parts which were occupied by the demi tints, in greater or less quantities, according as by their intensity. These demi tints approached more or less to the light, or to the shaded parts. With the aid of the feeble light of a candle, the operator may follow, step by step, the gradual formation of the image; he may see the mercurial vapour, as if with an extremely delicate, but invisible pencil, trace out in its proper proportions and tints, every part of the image. After the plate has been immersed and *agitated* in the solution of hyposulphite of soda, it should be washed in *hot* distilled water.

When we seek for an explanation of this singular phenomenon, the idea naturally occurs to the mind, that the light in the camera obscura determines the evaporation of the iodine, wherever it touches the yellow covering; that there the metal is left bare; that the mercurial vapour acts freely upon the parts thus exposed, and produces a dead white amalgam; and that the object of the washing in the hyposulphite, is the removal of those particles of iodine which have not been disturbed by the light. But in this last theory, what can those innumerable demi tints be, which are so marvellously graduated in the Daguerreotype? A single fact will prove, that the process is not so simple as it may at first appear: the weight of the plate is not perceptibly increased by the covering of yellow iodine. The augmentation is, on the contrary, very sensible under the action of the mercurial vapour; but M. Pelouze has ascertained, that after washing in the hyposulphite, that the plate, notwithstanding the pre-

sence of the amalgam on the surface, *weighs less than before the commencement of the operation.* The hyposulphite must, therefore, take away a portion of the silver; and the analysis of the liquid proves that it is really so. To account for the effects of light exhibited in the Daguerre pictures, it appeared sufficient to admit that the surface of silver was covered during the action of the mercurial vapour, with particles of amalgam; that these particles, very close in the light parts, diminished gradually in number in the demi tints, and were entirely absent in the black. This conjecture has been verified. M. Dumas has ascertained, with the assistance of a microscope, that the light and demi tints are really formed by sphericles, whose diameter appeared to him, as well as to M. Adolphe Bronguiart, to be uniformly one *eight hundredth of a millimetre.* But why then the necessity of inclining the plate at an angle of 45° at the moment of the precipitation of the mercurial vapour? This inclination, supposing it indispensable, as declared by M. Daguerre, does it not appear io indicate the intervention of crystalline needles, or threads arranging themselves vertically in the liquid, or demi liquid, and thus assuming an inclination, relatively to the plate, dependent upon the angle at which the ascending current of vapour met the plate? There will probably be thousands of beautiful pictures produced by this process, before its mode of action is completely understood. M. Arago's printed note contains also the announcement of an important fact, which augments the practical utility of M. Daguerre's invention; a fact which the learned academician had forgotten to mention in his communication of the 19th.

The necessity of preserving the pictures from all contact, appeared to be a serious obstacle to the propagation and general adoption of the method. During the discussion in the legislative Chambers, M. Arago was very desirous that some kind of varnish should be applied to protect the delicate and frail designs from injury; but M. Daguerre objected to the adoption of anything that he conceived would in the slightest degree derange their accuracy or effect. M. Dumas, the celebrated chemist, was then applied to, and he found that the pictures in question may be varnished; he recommends that a boiling solution of one part of dextrine in five parts of water, be poured upon the metallic plate. If it is found that this varnish does not in the course of time act on the mercurial compounds of which the image is formed, an important problem will be solved. This varnish will enable the engraver, by the means of transparent paper, to take an accurate copy of any picture; and if a plate of copper silvered on the surface, were substituted for the plated metal, the engraving might be performed of the plate itself. M. Daguerre affirms, that silvered copper will receive as perfect a design, as the plated metal he usually employs.

LONDON SCHOOL OF INSTRUCTION AND INDUSTRY.

We are indebted to the polite attention of the directors of the Kent Zoological and Botanical Gardens, for an invitation to a *grand fête*, given on Thursday for the benefit of the above-named institution. The School of Instruction and Industry was established in 1806, and since that period, has imparted to a vast number of poor children, the rudiments of useful and religious education, and the practice of various mechanical arts. The charity is under the patronage of her Majesty the Queen, the Queen Dowager, the Duchess of Kent, and the Duke of Wellington, and has also had the support of many influential persons connected with the city of London.

The gardens of Rosherville were selected for the scene of festivity, and the *City of London* steamer conveyed a numerous and conspicuously respectable party of the friends of the institution to the delightful spot, where mirth, mingled with a truly benevolent purpose, disposed the guests to enjoy the picturesque scenery of the gardens, and an excellent collation, a simultaneous attack upon which was made by the whole of the company, at the warlike sound of the trumpet. The usual loyal, patriotic, and other favourite toasts were given and drunk with evident sincerity. The children of the school were then introduced, and paraded through the grand tent, each bearing some specimen of his or her manufacture. The appearance of the children, and the neatness of their workmanship, attracted general admiration, and it is scarcely necessary to say, that the little artisans received more solid proofs of sympathy than mere praise. Addresses were then delivered by a girl and boy, setting forth their destitute condition, and their gratitude for the advantages they had derived from the institution. Their simple and artless recitals excited the warmest sympathies from every one present. At seven o'clock the party separated, more than usually gratified with their entertainment.

DURABILITY OF BUILDINGS.

The following examples of the degree of durability of various edifices, are given in the Report of Mr. Barry on the selection of stone for the new Houses of Parliament, from which we have already laid extracts before our readers:—

"Of the sandstone buildings which we have examined, we may notice the remains of Ecclestone Abbey, of the thirteenth century, near Barnard Castle, constructed of a stone closely resembling that of Steton quarry, in the vicinity, as exhibiting the mouldings and other decorations, even to the dog's tooth ornament, in excellent condition. The circular keep of Barnard Castle, apparently also built of the same material, is in fine preservation. Tintern Abbey may also be noticed as a sandstone edifice, that has to a considerable extent resisted decomposition; for, although it is decayed in some parts, it is nearly perfect in others. Some portions of Whitley Abbey are likewise in a perfect state, whilst others are fast yielding to the effects of the atmosphere. The older portions of Ripon Cathedral constructed of sandstone, are in a fair state of preservation. Rivaulx Abbey is another good example of an ancient sandstone-building in a fair condition. The Norman keep of Richmond Castle, in Yorkshire, affords an instance of moderately hard sandstone, which has well resisted decomposition.

"As examples of sandstone buildings of more recent date in a good state of preservation, we may mention Hardwicke Hall, Haddon Hall, and all the buildings of Craigleith stone in Edinburgh and its vicinity; of sandstone edifices in an advanced stage of decomposition, we may enumerate Durham Cathedral, the churches of Newcastle-upon-Tyne, Carlisle Cathedral, Kirkstall Abbey, and the Fountains Abbey. The sandstone churches of Derby are also extremely decomposed, and the church of St. Peter, at Shaftesbury, is in such a state of decay, that some portions of the building are only prevented from falling by means of iron ties.

"As an example of an edifice constructed of a calciferous variety of sandstone, we may notice Tilsbury church, which is in unequal condition, the moulding and other enrichments being in a perfect state, whilst the ashler, apparently selected with less care, is fast mouldering away. The choir of Southwell church may be mentioned as affording an instance of the durability of a magnesio-calciferous sandstone, resembling that of Mansfield, after long exposure to the influence of the atmosphere.

"Of buildings constructed of magnesian limestone, we may mention the Norman portions of Southwark church, built of stone similar to that of Bolsover-moor, which are throughout in a perfect state, the mouldings and carved enrichments being as sharp as when first executed. The keep of Koningsburg Castle, built of a magnesian limestone from the vicinity, is also in a perfect state, although the joints of the masonry are open in consequence of the decomposition and disappearance of the mortar formerly within them. The church at Hemmingsburgh, of the fifteenth century, constructed of a material resembling the stone from Huddlestone, does not exhibit any appearance of decay. Tickhill church, of the fifteenth century, built of a similar material, is in a fair state of preservation. Huddlestone-hall, of the sixteenth century, constructed of the stone of the immediate vicinity, is also in good condition. Roche Abbey, of the thirteenth century, in which stone from the immediate neighbourhood has been employed, exhibits generally a fair state of preservation, although some portions have yielded to the effects of the atmosphere. As examples of magnesian limestone buildings in a more advanced stage of decay, we may notice the churches at York, and a large portion of the Minster, Howden church, Doncaster old church, and others in this part of the country, many of which are so much decomposed, that the mouldings, carvings, and other architectural decorations, are often entirely effaced. We may here remark, that as far as our observations extend, in proportion as the stone employed in magnesian limestone buildings is chrystalline, so does it appear to have resisted the decomposing effects of the atmosphere; a conclusion in accordance with the opinion of Professor Daniel, who has stated to us, that from the results of experiments, he is of opinion, that the nearer the magnesian limestones approach to equivalent proportions of carbonate of lime and carbonate of magnesia, the more chrystalline and better they are in every respect.

"Of buildings constructed of oolitic and other limestones, we may notice the church of Byland Abbey, of the twelfth century, especially the west front, built of stone from the immediate vicinity, as being in an almost perfect state of preservation. Sandyfoot Castle, near Weymouth, constructed in the time of Henry the Eighth, is an example of that material in excellent condition, a few decomposed stones used

in the interior (and which are exceptions to this fact) being from another oolite, in the immediate vicinity of the Castle, Bow and Arrow Castle, and the neighbouring ruins of the church, of the fourteenth century, in the island of Portland, also afford instances of the Portland oolite in perfect condition. The new church in the island, built in 1766, of a variety of the Portland stone termed Roach, is in excellent state throughout, even to the preservation of the marks of the chisel.

The churches of Stamford, Ketton, Colley Weston, Kettering, and other places in that part of the country, attest the durability of the shelley oolite, termed Barnard Rag, with the exception of those portions of some of them, for which the stone has been ill selected. The excellent condition of the parts which remain of Glastonbury Abbey, show the value of a shelley limestone similar to that of Doulting; whilst the stone employed in Wells Cathedral, apparently of the same kind, and not selected with equal care, is in parts decomposed.

"In the public buildings of Oxford, we have a marked instance, both of the decomposition and durability in the materials employed, for whilst a shelley oolite, similar to that of Taynton, which is employed in the more ancient parts of the cathedral, in Merton College chapel, &c., is generally in a good state of preservation, a calcareous stone, from Heddington, employed in nearly the whole of the colleges, churches, and other public buildings, is in such a deplorable state of decay, as in some instances to have caused all traces of architectural decoration to disappear, and the ashler itself to be in many places deeply disintegrated.

"In Spofforth Castle, we have a striking example of the unequal decomposition of two materials, a magnesian limestone and a sandstone: the former employed in the decorated parts, and the latter for the ashler or plain facing of the walls. Although the magnesian limestone has been equally exposed with the sandstone to the decomposing effects of the atmosphere, it has remained as perfect in form as when first employed, whilst the sandstone has suffered considerably from decomposition.

"Judging, therefore, from the evidence afforded by buildings of various dates, there would appear to be many varieties of sandstone and limestone employed for building purposes, which successfully resist the destructive effects of atmospheric influence. Amongst these, the sandstones of Stenton, Whitby, Tintern, Rivaulx, and Craigleith; the magnesio-calciferous sandstone of Mansfield; the calciferous sandstone of Tinsbury; the chrystalline-magnesian limestone or Dolomites of Bolsover Moor, Huddesline, and Roche Abbey; the oolites and limestone of Barnack and Hambill, and the siliciferous limestones cf Chelmark, appear to be amongst the most durable. To these, which may all be considered desirable building materials, we are inclined to add the sandstone of Darley Dale, Hambil, Longannet, and Crowbank; the magnesian limestone of Robin Hood's Well, and the oolite of Ketton, although some of them may not have the evidence of ancient buildings in their favour."

RAILWAYS AT THE ANTIPODES.

SOUTH AUSTRALIAN RAILWAY.

We congratulate our friends, and all who are interested in the success of the colony, that there is a mature plan before the public for the formation of a tram-way from the Port to the town of Adelaide.

Mr. Kingston, the deputy surveyor-general, who examined the district intervening between the two places, reports that "it is very favourable for a rail-road, the fall being pretty nearly uniform, and the average inclination about 1 in 600." The distance is about six miles.

Mr. Gouger states, that the nature of the soil is favourable, and that the land has good natural drainage, the only obstacles being two small gullies, which are even now passed by loaded carts. The firmness of the soil is also shown, by its affording a tolerable road in its natural state. But the occupation and fencing-in of the lands adjoining the road-way will, as it proceeds, restrict the vehicles to a comparatively narrow track; whereby, as the traffic increases, the wear will soon render the formation of a road of some kind, a matter of absolute necessity. A railroad is the best of roads. We have now a clear field, and our means are untouched. The superiority of a railway is so great, that it is surely true economy to make an effort to obtain one at once. No private lands need be crossed—no adverse interests have grown up—no natural obstacles of any importance are interposed—no legal difficulties stand in the way requiring an Act of Parliament to remove them. It is seldom that an undertaking is proposed, which has so few obstructions to overcome.

The quantity of goods, and the number of persons passing between Adelaide and the port, are such as would probably make a railway very profitable, were it now in

existence; and, looking back at the rapid increase which time has brought with it, we trust, that when the period for the opening of the railway arrives, the shareholders will have reason to be highly satisfied with the amount of the trade ready to pass along the line; and, if the same principles operate in Australia which are found to be all powerful at home, the great facility afforded by the railway itself will, in time, powerfully stimulate the traffic.

The advantages which this undertaking is calculated to confer upon the colony, if conducted upon liberal principles, as we trust it will be, are so great, that we think every landholder, bondholder, and trader to the colony, would act wisely in promoting its speedy accomplishment by the best means in his power.

At present, the business of carrying is in the hands of individuals, whose operations being uncombined, and of limited extent, are, of course, slow, expensive, and frequently insufficient. Much of the property, too, being from its nature susceptible of injury, suffers more from the jolting to which it is exposed in traversing these six miles of natural surface, than it does from the time of its leaving the maker's hands in England, till its arrival at the port.

Upon a railway the transit will be rapid, certain, safe, and economical; for, though the rate of charge proposed, 12s. per ton, appears very high to us here, it is low compared to what is now paid in the colony, 30s. per ton being the lowest rate we know of, and this for the very inferior conveyance.

The rate of charge will, no doubt, be diminished considerably in progress of time; because, as the main expenses of a railway are fixed, and consequently do not vary with the amount of traffic, the large amount of business which a low rate of charge tends to ensure, is generally found to yield a greater profit than the smaller amount consequent upon the restriction of a high charge.

The wonderful power of regular, cheap, and rapid communication in developing the natural and industrial resources of a country, need scarcely be insisted upon, since it is daily manifested wherever roads, canals, railways, and steam vessels are known and used; that is, all round us at home, and, perhaps, more strikingly still in the United States of America. It will be a proud day for South Australia, when she, the youngest of the British colonies, and, hitherto, wholly self-supported, shall possess an advantage not yet obtained by the older colonies, upon which nevertheless immense public treasures have been lavished.

Though the Directors of the South Australian Railway Company propose, in the first instance, to construct a single line, and for horse carriages only, as involving but a moderate outlay, and being suitable to the present circumstances of the colony; yet, it cannot but be in expectation, that, at no very distant period, a double line, suitable for locomotive engines, will be demanded by the advanced prosperity and multiplied population, which may be almost securely counted upon, in which case the superstructure of the railway now proposed must be removed to some other line at which it can be rendered serviceable.

Meantime, we understand, that upon the successful issue of its first operation, the Company contemplate the erection of wharfs, with suitable cranes, sheds, &c., at the port, and of warehouses at each end of their line, for the storing of goods which cannot at once be conveyed to their ultimate destinations; also, we believe, they intend to employ steam-tugs to bring vessels into port, and to provide for supplying water, ballast, &c. to the shipping, so that when their arrangements are complete, the master of a vessel, upon his arrival at the mouth of the harbour, can at once agree with the Company for the haulage of his ship into port, the unloading, storing, and carriage of the cargo, for his supply of water, ballast, &c., and lastly, for haulage out of port. The convenience, economy, and despatch consequent upon such a plan, if ably and liberally carried out, are obvious.—*South Australian Record.*

THE CHEMIST.

GALVANISM.

(*Continued from page* 349.)

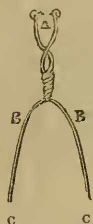
45. The spark from a galvanic battery acts with astonishing rapidity on inflammable bodies, when discharged through them. It fires gunpowder, ether, spirit of wine, &c.; it renders red hot fuses, and consumes very slender metallic wires, and leaves such as tinfoil, gold, silver, and copper leaves. Six of the small batteries described in article 40, are quite sufficient for exhibiting on a small scale most of the experiments I am now about to mention. The combustion of the metals may be exhibited in the following manner:—Pour into a watch glass a sufficient

quantity of mercury to cover the bottom, into which place one of the poles of the qattery; to the other attach a small portion of any of the metallic leaves; if either of these be brought into contact with the mercury in the watch glass, the metallic leaf will undergo vivid combustion, displaying different colours according to the metal employed; for instance, copper leaf, commonly called Dutch metal, burns with a beautiful green light; silver with a pale blue, and gold with a yellow light.

46. The combustion of steel wire may be exhibited in the following manner:—Attach to one of the poles of the battery a piece of fine steel wire, and to the other a piece of well-burnt charcoal (made of box-wood or ebony), and scraped to a fine point, like a pencil; the wire, on being made to touch the charcoal, will undergo combustion, throwing out very brilliant scintillations.

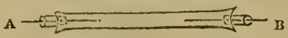
47. Take two of the pieces of charcoal mentioned in the former experiment, and fasten each piece to either pole of the battery; if these pieces are now brought carefully together, the brilliant galvanic light will be evolved, accompanied with the combustion of the charcoal. The most refractory substances melt when placed in this flame.

48. In order to produce the ignition of platina wire, bend a piece of copper wire, as shown in diagram. B B, the copper wire, connect the two ends of the apparatus, C C, with the poles of the battery before mentioned, and the platina wire will become red hot.



49. Colonel Pasley, of the Royal Engineers, has made a very ingenious application of the above experiment, to the blowing up of sunken vessels. He introduces an apparatus of the above description into the powder to be exploded; the charge of powder thus prepared, is introduced into the vessel by means of the diving-bell, and as soon as the communication between the poles of the battery employed is effected, the discharge takes place. A Mr. Martyn Roberts has also made an application of the same power to the blasting of rocks. The blowing up of sunken vessels by the means before mentioned, may be seen at the Polytechnic Institution, Regent-street, in operation daily.

50. One of the most extraordinary effects of the galvanic battery, is the decomposition of water. Fill a small glass tube with distilled or rain water, and fitting a cork to each extremity, as in the following figure, pass a piece of copper



wire through the corks into the water, then connect the wire, A, with one extremity of the battery, and the wire, B, with the other, you will then perceive minute bubbles of gas proceed in a constant stream from the end of the wire, which passes from the negative pole of the battery, and at the same time the wire, which proceeds from the positive pole, deposits a stream of oxyde in the form of a cloud, which gradually accumulates on the sides and bottom of the tube.

51. In this experiment, it appears that the hydrogen is separated from the water by the wire connected with the negative extremity of the battery, whilst the oxygen unites with and oxydates the wire proceeding from the positive pole of the battery.

52. All bodies have a peculiar relation to electricity, so that when they are separated from their various combinations, they are attracted to a positive or negative pole, as is observed in the decomposition of water. Those bodies are called *electro-negatives*, which, when separated from other substances by electricity, are attracted to the positive pole; those are called *electro-positives* which, under similar circumstances, are attracted to the negative pole.

(To be continued.)

PHOTOGENY.

To the Editor of the Mechanic and Chemist.

SIR,—Much has lately appeared in your valuable publication on the subject of photogeny, and knowing your readiness to protect inventors by recording a proof of the priority of their discoveries which, in five times out of six, is usurped by others who do not scruple to apply them to themselves, I beg for the information of your numerous readers to state, that prior to the Daguerreotype being published, I was enabled to obtain a perfect image of a building *on a silver plate*, by acting on it with chlorine gas; the difficulty afterwards was the fixing process, which I was unable to accomplish. As I have named this to others since Daguerre's secret has been published, I think it not at all unlikely, as my experiments have before appeared in print, that advantage will be taken of it, as I am now engaged in Daguerre's method, and have since obtained

results sufficient to convince me that it can be applied to paper as well as metal.

I remain yours, &c.

James Robinson.

8, Store-street, Bedford-square.

[Even at this thirteenth hour, we shall be glad to give publicity to a more minute description of the process and result of our correspondent's discovery; although confessedly inferior to "the great secret," it may lead to some new train of reasoning in photogenic science.—Ed.]

Migratory Plants.—Among animals, some are migratory, and others stationary and permanent; the same variety is observable in plants. Although mostly stationary, yet there are many that may be regarded as migratory or locomotive. The root of a scabious, for instance, if planted in a certain spot, will, after the lapse of a few years, be found to have left its situation, and it will be perhaps only after a search, which will lead the inquirer a distance of half an acre, that it will be found. Some male plants are known to sail from shore to shore over the water in pursuit of those of the opposite kind, and numerous tribes float through the expanse of ocean.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Sept. 12, G. F. Richardson, Esq., on Geology. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Sept. 10, Dr. John Walker, on the Ear. At a quarter to nine.

QUERIES.

Sir,—You would oblige me by giving your opinion as to spelling the word "segar" or "cigar."

An Aeronaut.

[The proper spelling is *cigar*; it is written with a C in the languages from which we have derived it.—Ed.]

A receipt for making a bright, but very dark red ink; I have tried several receipts, but always failed to procure that depth of colour that I see even in the commonest accompt books?

Northampton. A. B.

The best method of making or preparing burnt oil, commonly called printer's oil, both weak and strong? E. Jubber.

How to clean out a greasy barometer tube? I have tried cotton wool, which does not appear to answer. Also, how to purify quicksilver from alloy, by some other method than distilling, as I find a difficulty in procuring an iron retort here?

Sheffield. J. Y.

1. How are those lucifer-matches made which light by being rubbed against anything? 2. How can the composition be taken off those we can buy, to put it on others, without injuring its igniting effects? It appears to be made of phosphorus, but I cannot melt it in hot water, as I can phosphorus. I can dissolve it by steeping it a long time in cold water, but it loses its glutinous property, and will not again stick to the match. 3. How are steel pens varnished?

T. Z.

ANSWERS TO QUERIES.

"G. H. S." of Nos. 142 and 143, is informed, that the varnish to join the lute-string (or a fine kind of silk), is made of Indian rubber dissolved in turpentine. The lute-string being varnished and dried, is cut according to the shape of the balloon wanted, which is usually conical; the different pieces are cut larger than the pattern, that the edges may overlap, and they are then united by passing a heated iron, with an intervening fold of paper along them, by which means the varnish is slightly melted, and the pieces adhere; being at the same time stitched along the seam. The gas used for filling the balloon is usually made by pouring sulphuric acid and water upon iron filings, the gas then rises, and is conveyed into the balloon by means of a pipe. Common coal gas is now often used.

An Aeronaut.

To Dissolve India Rubber.—"P. T." There are several kinds of naptha. It is the naptha which is made from coal tar that will dissolve India rubber, and it will do it in an hour or two. It will dry again in an hour, and be the same as it was before. T. Z.

To Harden Steel.—"R. S. D." Steel may be hardened without warping, in the following composition, and may bring it back to a spring temper, that will bear bending any way without breaking, by just wiping off the superfluous with a piece of rag, and carefully burning the rest off over a gentle fire. Melt together train oil, two parts; rosin one part, and good tallow, one part.

T. Z.

TO CORRESPONDENTS.

W. W. *has our thanks for his talented contribution, and we shall always be glad to receive any communication he may favour us with.*

W. H. C. *will find an answer to his query in our next.*

D. G. R.—*As soon as diagrams are ready.*

J. B. *wishes to know if it is right to say, that St. Paul's church is* 400 *feet high, speaking in* round numbers;—*certainly not:* $20^2 = 400$, *therefore* 400 *must be a* square *number. The height he has stated correctly within three or four feet.*

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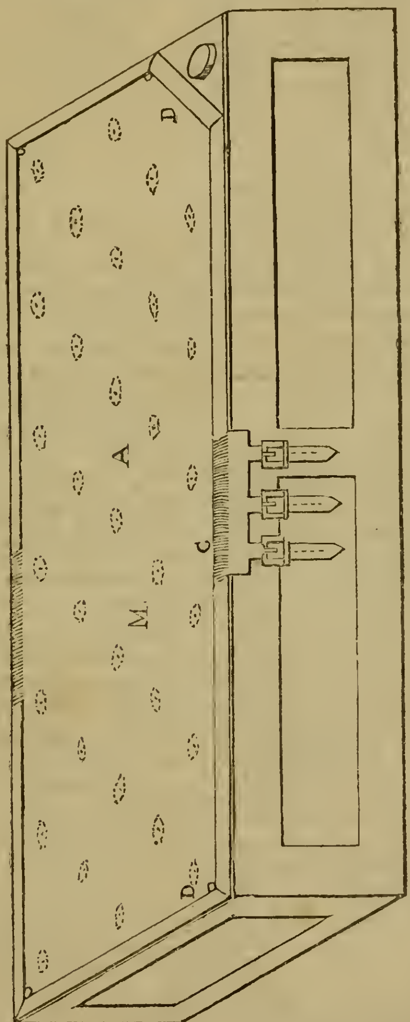
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. XLVI. & XLVII. NEW SERIES.	SATURDAY, SEPT. 14, 1839. (PRICE TWO PENCE.)	Nos. CLXVII. & CLXVIII. OLD SERIES.

DR. ARNOTT'S HYDROSTATIC BED.



City Press, 1, Long Lane, Aldersgate Street : D. A. Doudney.

DR. ARNOTT'S HYDROSTATIC BED.

This valuable invention is as much recommended for the simplicity of its construction, as the facility of its application, for the more important purpose it is designed to serve, in alleviating the sufferings of humanity. It consists of an oblong case of water, upon the surface of which a mattress, A, preserved perfectly dry by the interposition of a water-proof cloth, is kept constantly floating. The water, by its yielding and equal pressure, causes the mattress to adapt itself to the inequalities of the body, and prevents the accumulated pressure on the prominent points, which, in a common bed, occasions uneasiness and excoriation, in cases of long confinement. In cold weather, a little warm water may be added to raise the temperature to any required degree. The water is poured in at an aperture, B, till the mattress rises to a level with the edge of the case. C C is a belt buckled on either side by three straps, and assists in supporting the patient in lying down, or rising; D D are small pipes at the corners of the mattress, for ventillation, in order to allow the insensible perspiration to escape.

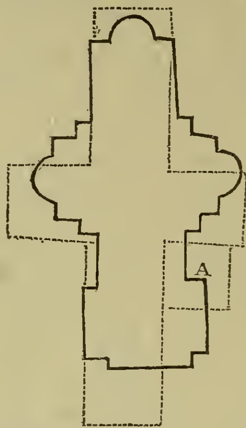
HISTORY OF ARCHITECTURE.

NO. VI.

(Continued from page 322.)

Architecture, which for a long period after Jones's decease had been much neglected, was again revived by the immortal Sir Christopher Wren. This celebrated individual, whose abilities as an architect *are* not and *cannot* be too highly extolled, was born A.D. 1632. His attention was for a considerable time devoted to the acquirement of general knowledge, and the study of general literature; and it was not until after the death of Inigo Jones, that he displayed his talents in this branch of science now before us. He was appointed to fill the office of surveyor-general in 1667, and for fifty-one years performed its duties with great skill and assiduity. In 1718 he was, however, unjustly ejected.

The great fire of London, which happened in 1666, opened to Wren's genius a wide field of exercise. He was employed to rebuild most of the public buildings then destroyed. Among them was the present cathedral of St. Paul, of which it has been rightly remarked, "Whatever be the objections raised against parts of it, by the taste of some, and the jealousy of others, it remains a lasting monument of his (Wren's) genius in decorative and unexampled skill in constructive architecture." I am enabled to give a plan, showing the relative sizes and positions of the two cathedrals of St. Paul.



This was taken from a copy of the original drawing by Sir Christopher, which is now in a state of preservation at All Soul's College, Oxford. The dotted lines represent the *old*, and the drawn, the *new* cathedral. The part marked A, shows the site of the ancient cloisters. Many of the old city churches and other public edifices, can be attributed to this great man; *great* especially in Watt's acceptation* of the term. Thus, St. Stephen's, Walbrook, a most beautiful church, and universally considered to be Wren's masterpiece, Bow church, Cheapside, St. Bride's, Fleet-street, the *old* College of Physicians, Chelsea College, and many others, are among the numerous works of this architect. He died on February the 25th, in the year of our Lord 1723, aged 91 years. The works of an architect form his best monument. This opinion is recognised in one of Wren's noblest monuments; for, immediately above the entrance to the choir of St. Paul's Cathedral, stands the following inscription:—"Subtus conditur hujus ecclesiæ et urbis conditor Christophorus Wren qùi vixit annos ultra nonaginta non sibi sed bono-publico. Lector si monumentum requiris circumspice†."

Proportio.

* "The *mind's* the standard of the man."

† Beneath lieth Christopher Wren, the builder of this church, and of this city, who lived above ninety years, not for himself, but for the public good. Reader! if thou seekest his monument, look around.

PENNY POSTAGE.

No definite plan is yet fixed upon for carrying into effect the new postage law; the paper-makers and stationers are of opinion, that the chief object in organizing the system, should be the increase of their trade, but the public, the legislature, and the government, have more important and nobler objects in view. An article has appeared in the *Scotsman*, strongly condemning the attempt made to oppose Mr. Hill's plan, by raising a cry against the envelopes invented by Mr. Dickinson.

"A great national improvement, it states, has never been opposed on such paltry grounds. The grievance, they say, in the eyes of certain paper-makers and stationers, is, "that some one individual who furnishes the stamps by contract, will have a great profit, which cannot be divided among themselves. Setting aside the use of stamped covers would not add to their gains—nay, it would rather diminish them, by rendering the plan less commodious to the public. It is true, a short note would sometimes be written upon the envelope itself, and there would be no enclosure; but we do not believe that this would be done in one case out of twenty. Mr. Dickinson thinks that four notes out of twelve might be so written; but this is an obvious exaggeration, arising from his desire to show that, by employing these envelopes, the public might save a certain quantity of paper otherwise. After all, the expense of envelopes would be trifling. Mr. Dickinson thinks, that 144 made of his patent paper, and ready stamped, could be furnished wholesale for one shilling, or one-third of a farthing each; and upon this subject he is a good authority. "We fully agree," says the writer, in conclusion, "with those who think that the advantages of Mr. Hill's plan are not only commercial and economical, but moral, and that in a very high degree. The facilities it will afford for the interchange of thought, and the diffusion of ideas, must be immense; but they will not be fully seen or appreciated till it has been many years in operation."

The course at present pursued by the government must give general satisfaction; the whole country is appealed to in order to obtain the best information respecting the mode of carrying the proposed plan into effect; two hundred pounds are promised to any individual who can produce a description of the best and simplest process of transmitting letters either by stamps or otherwise, according to the stipulations of the new law; the second best is to receive one hundred pounds. This is a subject worthy of the consideration of our ingenious readers; for though an intimate knowledge of the business of the Post Office is required in the organization of a complete system, such as would entitle the author to the first prize, yet any suggestion that might be considered useful, would, no doubt, obtain a proportional reward. We invite our readers to address their ideas on this subject to us, as a means of securing their title to priority, should it afterwards be contested.

MARINE RAILWAY.

The *Courier de Bordeaux* contains a description of the marine railway, an apparatus introduced into France from the United States, and by means of which, vessels of any size can be hauled ashore in an upright position for the purposes of careening, &c. By means of this railway a vessel was hauled up and lowered again the other day in the presence of the Duke and Duchess of Orleans. It consists of a railway which may be prolonged indefinitely under the water to suit the rise or fall of the tide, and also on shore according to the size of the ship yard. Upon this an immense kind of wooden carriage, proportioned to the size of the vessel, is made to traverse by means of strong capstans. This carriage is of such a nature, that it can be got under the keel of a ship, or rather the ship may be made to float on to it, and by means of a system of wedges and ropes, can thus be so adapted to the hull, as to fit and embrace it tightly all round. The ship is kept in the perpendicular, either with or without her cargo or crew on board, and the capstans being set to work, the carriage and its burden are hauled up the railway at the rate of from two to three feet per minute. The advantages of this system over that of dry docks, or of laying a vessel on its side, are stated to be very great; and a great saving of time and money is also effected. It was brought into France by M. Plantevigue, of Bordeaux, who has taken out a patent for it.

RAILWAY TRAVELLING.

Like every other great public improvement, the railway system will propagate itself. Not only must the successful results which have followed the introduction of railways into particular districts induce those who are interested in the prosperity of other districts, and favourably disposed to the new mode of communication, to try the experiment there, but that very success will compel those who are not friend-

ly to railways to have recourse to them in self-defence. They will find that other localities are progressing, and that if they themselves would not be left behind, they must adopt the same means of going forward as their neighbours. This consideration was strongly impressed upon us while reading, in a local paper, the report of the proceedings at a public meeting held in Falmouth a few days ago. The inhabitants had assembled in the Guildhall, for the purpose of receiving the report of a deputation appointed to communicate with Lord Melbourne, and other members of her Majesty's government, and to devise means for preventing, if possible, the contemplated removal of the packets from that port. The Report was most unsatisfactory; but that with which we have more immediately to do is this, that it appeared to be the general conviction of the meeting, that unless a railway could be constructed from Exeter to Falmouth, the town must be entirely ruined. We presume, therefore, that a railway will forthwith be set on foot, and that the inhabitants of Falmouth, if they do not succeed in securing the object at which they now aim, will participate in the benefits which such an addition to the great chain of railway communication with the metropolis must create.

The inhabitants of other towns, as well as the good people of Falmouth, are beginning to see, that in neglecting to secure to themselves the benefit of railway communication, they have been acting most suicidally. Some of them are attempting to remedy the evil by patronising those self-styled rivals (that *are to be*) of railways—the common-road steam conveyances. If a railway cannot be obtained—and in several instances the previous obstinacy of the parties now so anxious, has rendered *that* impossible—they must find as good a substitute as they can; but we would advise all who have it in their power to procure the better mode of communication, not to remain satisfied with the worse. If they do, they may soon have occasion, like the Falmouth folks, to mourn over the departed glories of their several cities or towns. In the present march of mind and matter, the laggard must expect to be left behind. The Yankee motto is the motto of the existing generation of Englishmen:—"Go A-HEAD!"—*Railway Times.*

On Tuesday last the time expired for testing the experimental paving laid down in Oxford-street, when the Committee met and decided upon adopting the wood for the general pavement.

EFFECT OF LOW FARES.

The following letter refers to some previous remarks in the *Arbroath Herald*:—

"Sir,—I attach so much consequence to the subject-matter of some very sensible remarks in your paper of yesterday, headed, 'Arbroath and Forfar Railway,' that I go out of my usual way in thus addressing you, to request that you will correct an error of fact, which, if suffered to pass unnoticed, might have a tendency very prejudicial to the cause you so ably advocate.

"I believe the lowest class fares on the Antwerp Railway are below 1*d.* per mile; at all events those of the Arbroath and Forfar are so, being 1*s.* for fifteen miles and a quarter. At the time the Directors had the matter under consideration, they were deterred from making the fare 1*s.* 3*d.* as proposed to them, by the knowledge of the heavy loss the Dundee and Newtyle Company had at one time sustained, by raising the fares from the one of these sums to the other,—a loss amounting, I believe, to nearly 50 per cent. of their whole traffic. To accommodate all classes of the public to the greatest extent, the cost of travelling by railway must be made cheaper than that of walking on foot; and it would appear that a very slight excess is sufficient to turn the balance in the habits of the labouring classes. One of the principal arguments I have heard adduced against lowering fares is, that you thereby enable the richer classes to avail themselves of the privilege, and that a heavy loss is thereby incurred. That such has been, and always will be the case, wherever fares are lowered without reaching the competition point with walking, I am ready to admit; but let timid directors of railways take courage, reduce their fares below this point, and they will find their lowest class carriages fully occupied with a population not previously seen in them, that their higher-rated carriages will have at least their former proportion of tenants, and that the general profits of the undertaking will be greatly enhanced.

"Perhaps in consideration of the different rate of wages, one penny per mile would be the proper charge in England. I think it is shown in the Report of the Commons' Committee on railroads, 1838, that the average number of passengers per train on the Liverpool and Manchester, is 65, and of the General Junction 55. That of the Arbroath and Forfar has already exceeded this considerably.

"I am, Sir, &c.,

W. F. LINDSAY CARNEGIE."

THOMAS'S CARRIAGE SAFETY, OR TRAVELLER'S LIFE PRESERVER.

On Tuesday last several illustrations of the efficacy of a new invention were given by Mr. Thomas, of St. James's-street, for preventing accidents from horses suddenly taking fright. Nothing could be more simple or successful than this contrivance. By means of it, one, two, or more horses, in any vehicle, may be instantaneously stopped, even when at the most furious speed, and when altogether unmanageable by the ordinary reins. This exceedingly ingenious, though simple apparatus, is thus accurately described by the inventor himself:—

"On the nave of the wheel is fixed a small gun-metal wheel; in front of the axle runs a steel spindle, with small cog attached; over the spindle is a cylinder, and to which a check-string is fixed. The moment it is put in action, the spindle advances, and the cog revolves gradually round the gun-metal wheel, which is fixed on the nave, carrying with it reins leading from the horse's head, composed of cat-gut, or patent cord, covered with leather. As the wheel revolves, the cylinder, which is about an inch in diameter, is gathering up the reins, until the horses are brought to a stand still; when, by letting loose the check-string, the horses immediately have their heads free."

Mr. Thomas has very appropriately named his most valuable invention a "Carriage Safety, or Traveller's Life Preserver." By its universal adoption hundreds of lives could be preserved, and thousands of accidents every year prevented. As soon as it is known, it is sure to come into general use. It is remarkably simple and light in its construction, and is very neat in appearance; while it can be attached with the greatest ease, and at a small expense, to any cab, stanhope, carriage, or other wheeled vehicle of any description. The "Carriage-Safety" has this other very great advantage, namely, that the most feeble or nervous female, or even a mere child, may by its means, stop the most furious horses in an instant. Mr. Thomas, we are glad to perceive, has obtained her Majesty's royal letters patent for his highly valuable discovery. In a few years, we doubt not, it will be in general use. And certainly we must say, that those persons keeping their carriages or gigs who neglect to avail themselves of it, after they are made acquainted with its entire efficacy, incur a moral responsibility of a very serious nature.

WRECK OF THE ROYAL GEORGE AT SPITHEAD.

(From the Hampshire Telegraph.)

We have already mentioned that the great cylinder, containing about one ton of gunpowder, which was lowered down on the 23rd ult., which did not explode when the action of the galvanic battery was applied to its priming, had become, somehow, entangled amongst the wreck, and could not be extricated. The hawser which was attached to it being broken, and the down-haul rope having got foul of the ship's timbers, it was necessary to investigate matters by means of the "helmet divers;" and as these men could work only at slack water, a period which at spring tides is extremely short, many successive days were employed in this difficult research. At length, on the morning of the 30th, the cylinder was got at, and a hook rope being attached to one of its rings, the monstrous charge was drawn to the surface, when the whole of the powder was found to be saturated with water. The cause of this accident has not yet been ascertained, nor can it be till the cylinder is completely dismantled and inspected by Colonel Pasley, whose official duties have called him away to Chatham; and we shall, therefore, content ourselves at present with mentioning the fact. We may observe, however, that in every great operation of this kind, where almost all the circumstances are either new in themselves, or new in their application, failures of this kind are always to be expected; and that were an officer, from any fear of not succeeding at once, to hesitate in trying bold and energetic experiments, the service entrusted to him might remain for ever unperformed. It is the province of genius to conceive, and of talents and experience to execute, measures of "pith and moment," from which minor minds might shrink. But in the execution of their task, as they have not the presumption to suppose themselves infallible, so they readily avail themselves of the fresh instruction which every failure, if rightly observed, is sure to impart. And we have no doubt that Colonel Pasley, with his wonted sagacity and perseverance, will derive from the accident as alluded to, more expeditious, and even more economical methods of accomplishing the purpose entrusted to him by the Government, than if all had gone smoothly from the first. And here it may not be amiss to state what is the purpose of these operations. The *Royal George* was overset and went to the bottom on the 29th of

August, 1782, and she has been allowed to lie there during no less a period than 57 years—much to the disgrace, we must say, of the engineering science of this country—for the place where this enormous wreck has so long lain, is the most centrical, and in other respects, the best part of Spithead. During the war, when large fleets of line-of-battle ships and great convoys of traders, filled up the anchorage, the blank space which encircled the buoy of the *Royal George*, and which it was dangerous to approach without risk of loss both of cables and anchors—was often greatly lamented. Things are changed now, and should the *Blenheim* or *Pique*, which God forbid! go down to day at Spithead, we have no doubt whatever that in less than a fortnight, Mr. Sadler, the able master-attendant of the dock-yard, would raise her, and place her in safety in the basin.

In the case of the *Royal George* this is impossible, and the plan seems to be to blow her to pieces by a succession of great and small charges, and then raise the fragments by means of ropes attached to them by help of the diving bell. Many technical difficulties occur in this process, in placing and fixing the vessels properly, in sounding over the wreck, in warping and securing the lighters containing the charges, and, finally, in adjusting the boats and ladders by which the helmet-divers descend, or from which the diving-bell is lowered. In arranging and conducting the details of these complicated manipulations, Colonel Pasley, we are glad to see, has the advantage of Mr. Sadler's experience; and we are sure that his abilities, his cheerfulness, and his habits of resource, cannot fail to prove of the greatest use. The engineering details, on the other hand, are under the immediate arrangement of Captain Williams, of the Royal Engineers, and of Mr. Symonds, also of that corps, son of the Surveyor of the Navy. These officers, with a party of sappers and miners, live on board the *Success*, a frigate in ordinary, which, with no small consideration and foresight, had been moved out to Spithead, for the accommodation of the various parties employed on this service. Boats, officers, and seamen, are also furnished by H.M.S. *Pique*, Captain Boxer, to assist in the many laborious processes connected with these operations.

On Thursday, the 29th of August, being the anniversary of the day on which

" Brave Kempenfelt went down,
With twice four hundred men,"

Col. Pasley made an effort not to let the old ship be any longer in peace, and on this occasion he succeeded so completely, that if ever we had held the slightest doubt of his being able to accomplish the object in view, our apprehensions on this score must have been removed. Five successive charges were sunk and exploded on the wreck, and, so far as can be ascertained, with the most destructive effect. These charges, however, were comparatively small, the largest containing only 180 pounds of powder, the other four being 45 pounds each. They were all fired by means of Bickford's fuses, an ingenious device, by which a match is made to burn for two minutes under the water, before the fire reaches the charge, which then explodes.

The method of setting off these charges may interest our readers. A weight, say a pig of ballast, or, for economy, a heavy bag of sand or shingle, is lowered till it reaches the wreck, by means of a small slip rope, rove through an iron ring, both ends of the rope being kept on board the boat. To one end of the rope the vessel containing the charge is then made fast, and the other being manned, the match is lighted, the vessel plunged into the water, and the rope briskly hauled in, so that long before the fuse is burned out, the charge is close down to the ring, and the boat removed to a safe distance.

The first, or largest explosion, on the 29th, produced a double shock, sufficient to shake one of the largest Dock-yard lighters or lumps, from end to end, and to produce a sensation to those who were on board her, resembling a smart shock of electricity or galvanism. The interval between the shocks was very short, say the tenth of a second. The sound was sharper and louder than we had expected, of a quick, angry character. The effect on most persons was remarkable, but not the same on all. Several ladies who were present felt severely shaken in the back; many imagined they were thrown up an inch or two off the deck, and one person had a head-ache instantly after feeling the shock.

The water over the explosions was not in the smallest degree affected, so far as could be observed, for four or five seconds, when a boiling motion became apparent, and an evident rise in the water over a circular area of ten or twelve yards, accompanied by the most violent ebullition. Some go so far as to say the water rose four or five feet over the great explosion; we dare not say that it much exceeded a foot, or a foot and a half. Be this as it may, no smoke was seen, and at first only

a prodigious evolution of air or gas, and a violent commotion on the water. In the course of a few seconds a cloud of mud of a dark blue colour rose to the surface, accompanied by a disagreeable smell, caused either by the inflamed gunpowder, or by the fetid mud collected over the wreck. Several large fish were killed by the first explosion, but none by any of the others; at least, none rose to the surface.

What change Colonel Pasley may make in his operations when he comes to examine the unexploded cylinder, now recovered from the wreck, we cannot pretend even to guess. That he will not be baffled is all we are certain of; and as he has given out that an explosion on the great scale will be attempted on Tuesday the 3rd inst., we are nearly as certain that he will not disappoint the public. It is said the Lords of the Admiralty are to be present on the occasion.

We have since obtained from the same source the following additional particulars:

So many idle and erroneous statements are flying about respecting these interesting operations, that we have felt it a duty to our readers to ascertain and report the exact state of the case, without troubling them or ourselves with any speculations as to causes. On Thursday, the 6th, although the weather was very unfavourable, another of the large cylinders was lowered to the side of the wreck, and the galvanic spark again tried, but, as before, without effect; on the firing of the charge, one of the wires, owing to the tempestuous weather, having been broken. An impression having got abroad, that the galvanic action may have been interfered with by the depth of the water, and the length of the submerged wires, we have made particular inquiry into this branch of the subject, and we find that several minor explosions have been successfully made by Colonel Pasley, at Spithead, this week, by means of this very galvanic operation, at the depth of fifteen fathoms (which is two fathoms and upwards more than on the wreck), with every other circumstance equally similar to that used in the case of the great cylinder. In the mean time Colonel Pasley, unwilling to defer any longer active operations, has exploded a number of minor charges against the *Royal George*. By means of these explosions, which, we should mention, were fired by Beckford's fuses, after being hauled into their proper position by lines passed through rings by the divers, large pieces of the wreck have finally been wrenched off, and then drawn to the surface by ropes fixed to them by the divers. In this way Colonel Pasley has succeeded in bringing up fourteen feet of the main-mast, including that part embraced by the main deck partners, several large beams of from fifteen to twenty feet long, a knee marked L.XXVI.M., and a number of bolts, rings, and belaying cleats. The work of destruction being now fully commenced, still more active measures are taken to keep up a brisk fire, we may look for results more and more interesting every day. We regret very much to add that a serious accident occurred on Friday, on board the *Success*. One of the small metal vessels, containing a charge of gunpowder preparatory to an explosion, was incautiously thrown against a bolt and stove. Colonel Pasley ordered it to be taken to the Magazine, and emptied. This was done; but the person employed omitted the precaution which Colonel Pasley always prescribes in such cases, of rinsing the vessel out with water, and accordingly, just as the soldering process had commenced, a small quantity of powder remaining in the vessel exploded, and fractured the leg of the poor sapper employed to repair the damage. He was immediately sent to the Artillery Hospital, and we are glad to say is doing well. Two more huge beams, one of them covered with ring bolts, have been brought up to-day. That part of the wreck to which the large charge of powder was fired (260lbs.), has been examined by the divers, who report that it is so completely shattered, that by the help of the chain slings, it may all be brought up.

PROPOSAL OF A SOCIETY FOR THE STUDY OF PRACTICAL MECHANICS AND CHEMISTRY.

The increasing desire which the middle classes evince for information in every department of science, particularly those branches, in which mechanics and chemistry form a part, shows the immediate necessity of all students in the above branches of science combining together, and forming themselves into a society, in which practical mechanics and chemistry are exclusively studied; and affording to them those benefits which the Mechanics' Institution, and other similar institutions, have denied them, viz., practical mechanics and chemistry; for although they may be called the mechanics' institutions, &c., yet no person will attempt to deny that practical mechanics is in most of them totally excluded, and as to chemistry, that science is most imperfectly stu-

died, in consequence of usually one evening only in a week being devoted to it; and then what with the preparation of the various apparatus, which cannot be got at until the lecturer arrives, and that may perhaps be nine o'clock, from which take about ten minutes for the private business of the classes, and there is actually very little more than twenty minutes for the study of practical chemistry (if study it can be called), and which many readers of "the Mechanic" well know, is hardly sufficient time to perform a few of the most simple experiments, without entering into any explanatory part of the theory.

TYRO CHEMICUS.

[In recommending this project to the attention of our readers, we wish it to be understood, that we have no intention of disparaging or slighting the Mechanics' Institutions as at present constituted; we believe, on the contrary, that those excellent institutions have done, and are still doing, a vast amount of good; but a number of young men engaged in the same pursuits, and uniting for the attainment of one common object, must necessarily be productive of great benefit; a trifling deposit of money from each member, would be sufficient to procure a variety of useful instruments, and a library, if not extensive, composed of books suited to the wants of the members. Another important advantage derived from a society of this description, is the reciprocal instruction resulting from the intercourse of the members. Many difficulties may arise to a practical man, which would be sooner and more satisfactorily disposed of by a jury of workmen, than by all the erudition of the Royal Society. We wish success to the undertaking, and shall be happy at any future time, should our correspondent's plan be carried into effect, to promote the objects of the society by occasionally noticing their proceedings; and should any of our readers desire to communicate with the proposer, their letters may be left at "The Mechanic Office," for "Tyro Chemicus," to whom they will be delivered on application. All such letters must be *post paid.*—ED.]

THE ADVANTAGES OF KNOWLEDGE.

1. LET me request your attention to a few remarks on the utility of knowledge in general. It must strike us, in the first place, that the extent to which we have the faculty of acquiring, forms the most obvious distinction of our species. In inferior animals, it subsists in no small degree, that we are wont to deny it altogether, the range of their knowledge, if it deserves the name, is so extremely limited, and their ideas so few and simple. Whatever is most exquisite in their operation, is referred to an instinct, which working within a narrow compass, though with undeviating uniformity, supplies the place, and supersedes the necessity of reason. In inferior animals, the knowledge of the whole species is possessed by each individual of the species, while man is distinguished by numberless diversities in the scale of mental improvement. Now to be destitute in a remarkable degree of an acquisition which forms the appropriate possession of human nature, is degrading to that nature, and must proportionably disqualify it for reaching the end of its creation.

As the power of acquiring knowledge is to be ascribed to reason, so the attainment of it mightily strengthens and improves it, and thereby enables it to enrich itself with further acquisitions. Knowledge in general expands the mind, exalts the faculties, refines the taste of pleasure, and opens innumerable sources of intellectual enjoyment. By means of it, we become less dependent for satisfaction upon the sensitive appetites, the gross pleasures of sense are more easily despised, and we are made to feel the superiority of the spiritual to the material part of our nature. Instead of being continually solicited by the influence and irritation of sensible objects, the mind can retire within herself, and expatiate in the cool and quiet walks of contemplation. The author of nature has wisely annexed a pleasure to the exercise of our active powers, and particularly to the pursuit of truth, which if it be in some instances less intense, is far more durable than the gratifications of sense, and is on that account incomparably more valuable. Its duration, to say nothing of its other properties, renders it more valuable. It may be repeated without satiety, and pleases afresh on every reflection upon it. These are self created satisfactions, always within our reach, not dependent upon events, not requiring a peculiar combination of circumstances to produce or maintain them, they rise from the mind itself, and inhere, so to speak, in its very substance. Let the mind but retain its proper functions, and they spring up spontaneously, unsolicited, unborrowed and unbought. Even the difficulties and impediments which obstruct the pursuit of truth, serve, according to

the economy under which we are placed, to render it more interesting. The labour of intellectual search resembles and exceeds the tumultuous pleasures of the chase, and the consciousness of overcoming a formidable obstacle, or of lighting on some happy discovery, gives all the enjoyment of a conquest, without those corroding reflections by which the latter must be impaired. Can we doubt that Archimedes, who was so absorbed in his contemplations as not to be diverted by the sacking of his native city, and was killed in the very act of meditating a mathematical theorem, on, did not, when he exclaimed ευρηκα! ευρηκα! * feel a transport as genuine as was ever experienced after the most brilliant victory?

But to return to the moral good which results from the acquisition of knowledge; it is chiefly this, that by multiplying the mental resources, it has a tendency to exalt the character, and, in some measure, to correct and subdue the taste for gross sensuality. It enables the possessor to beguile his leisure moments (and every man has such) in an innocent at least, if not in a useful manner. The poor man who can read, and who possesses a taste for reading, can find entertainment at home, without being tempted to repair to the public-house for that purpose. His mind can find him employment when his body is at rest: he does not lie prostrate and afloat on the current of incidents, liable to be carried withersoever the impulse of appetite may direct. There is in the mind of such a man an intellectual spring urging him to the pursuit of *mental* good; and if the minds of his family also are a little cultivated, conversation becomes the more interesting, and the sphere of domestic enjoyment enlarged. The calm satisfaction which books afford, puts him into a disposition to relish more exquisitely, the tranquil delight inseparable from the indulgence of conjugal and parental affection: and as he will be more respectable in the eyes of his family than he who can teach them nothing, he will be naturally induced to cultivate whatever may preserve, and shun whatever would impair that respect. He who is inured to reflection, will carry his views beyond the present hour; he will extend his prospect a little into futurity, and be disposed to make some provision for his approaching wants; whence will result an increased motive to industry, together with a care to husband his earnings, and to avoid unnecessary expense. The poor man who has gained a taste for good books, will in all likelihood become thoughtful, and when you have given the poor a habit of thinking, you have conferred on them a much greater favour than by the gift of a large sum of money, since you have put them in possession of the *principle* of all legitimate prosperity.

I am persuaded that the extreme profligacy, improvidence, and misery, which are so prevalent among the labouring classes in many countries, are chiefly to be ascribed to the want of education. In proof of this we need only cast our eyes on the condition of the Irish, compared with that of the peasantry in Scotland. Among the former you behold nothing but beggary, wretchedness, and sloth: in Scotland, on the contrary, under the disadvantages of a worse climate and more unproductive soil, a degree of decency and comfort, the fruit of sobriety and industry, is conspicuous among the lower classes. And to what is this disparity in their situation to be ascribed, except to the influence of education? In Ireland, the education of the poor is miserably neglected, very few of them can read, and they grow up in a total ignorance of what it most befits a rational creature to understand; while in Scotland, the establishment of free-schools in every parish, an essential branch of the ecclesiastical constitution of the country, brings the means of instruction within the reach of the poorest, who are thus inured to decency, industry, and order.

Some have objected to the instruction of the lower classes, from an apprehension that it would lift them above their sphere, make them dissatisfied with their station in life, and by impairing the habit of subordination, endanger the tranquillity of the state: an objection devoid surely of all force and validity. It is not easy to conceive in what manner instructing men in their duties, can prompt them to neglect those duties, or how that enlargement of reason which enables them to comprehend the true grounds of authority and the obligation to obedience, should indispose them to obey. The admirable mechanism of society, together with that subordination of ranks which is essential to its subsistence, is surely not an elaborate imposture, which the exercise of reason will detect and expose. The objection we have stated, implies a reflection on the social order, equally impolitic, invidious, and unjust. Nothing in reality renders legitimate government so insecure as extreme ignorance in the people. It is this which yields them an easy prey

* I have found it! I have found it!

to seduction, makes them an easy prey to prejudice and false alarms, and so ferocious withal, that their interference in a time of public commotion, is more to be dreaded than the eruption of a volcano.—*From a discourse on the advantage of knowledge, by the Rev. R. Hall.*

CHUBB'S PATENT NIGHT COMMODES.

This is a very useful and ingenious invention, and from its convenience ought to have an introduction into every sick chamber, more especially as its price places it within the reach of most individuals. It is constructed upon the simple air-tight principle of the water joint, which renders the escape of any effluvia impossible, and obviates every objection to its being fitted to the various forms of cabinet furniture, requisite for the ease and convenience of the invalid.

THE BUDE LIGHT.

This has been tried on a large scale at the Surrey Zoological Gardens. It is stationed on the top of the glass house, the most commanding situation in the gardens. So brilliant and powerful is it, that the whole gardens, lake, panorama, &c., are illuminated, and seen almost as distinctly as by day. It is made use of, prior to the "Eruption of Mount Hecla," which is a signal that it will shortly take place, and thus affords the guests an opportunity of settling their "*footing.*" When the eruption is concluded, it is again lighted, for the purpose of showing the company out, which is decidedly an advantage to the proprietors, for in the darkness the flower-beds used to be much trampled on, and the plants damaged.

Proportio.

POISONOUS FOOD.

To the Editor of the Mechanic and Chemist.

Sir,—I send you the following extract of a letter from Switzerland, thinking it might perhaps be interesting to some of your readers:—"A short time back, at a public dinner in the canton of Zurich, several persons were poisoned from having eaten of hams which had been cooked some days previous to the dinner, and which, having been stowed away in a cellar, engendered, *it is supposed*, a sort of animal poison; eight persons died of its effects, and two or three hundred were more or less affected." I am myself totally ignorant of any venomous substance which could have been formed under the above-mentioned circumstances, and should therefore be much obliged if any of your chemical correspondents would favour me with their opinion on the subject, through the medium of your valuable Magazine.

I am, Sir, yours, &c.

J. Mogford.

Twickenham.

[The Swiss are in the habit of employing copper vessels in the process of cookery; and it is not an uncommon occurrence, that serious, and sometimes fatal accidents result from the mixture of poisonous matter with the food. We merely suggest this as the probable cause of the misfortune, inviting our readers to communicate any better explanation they may be in possession of.—Ed.]

COMPOUND INTEREST.

To the Editor of the Mechanic and Chemist.

Sir,—Would you inform me, through the medium of your valuable "Mechanic and Chemist" magazine, the way to work in decimals, 104 times by itself, to produce 148; the sum is in the "First Lines of Arithmetic," by the Rev. David Blair, but is not worked out. I give you a copy at foot, the answer will very much oblige

Yours respectfully,

J. Banks.

Manchester.

What is the compound interest of 450 pounds for 10 years at 4 per cent?

1.04 by itself ten times, is 1·48; then

450	666 Debt.
1.48	450 Principal.
3600	£216 Compound Int.
1800	
450	
Debt 666,00	

[Compound interest is derived from the supposition, that if the interest of money be not paid when due (which is commonly at the end of a year from the time of lend-

ing the principal) such interest should be considered as a new debt, and added to the principal, to bear interest with it for the ensuing year, and so on, from year to year, for any length of time that it remains unpaid.

Suppose 100*l.* to be lent at 5 per cent., if the 5*l.* interest be not paid at the end of the first year, the debt will be increased to 105*l.*, and the interest for the following year must be accordingly computed on that sum, which makes it amount to 5*l.* 5*s.*, and the principal at the end of two years will be 110*l.* 5*s.*, the interest of which is 5*l.* 10*s.* 3*d.*, and so on for each succeeding year.

The interest of any sum of money for one year, may be found by the following proportion :—

As 100*l.* : its interest : : the given sum : its interest. Also 100*l.* : 100*l.* + its interest : : the given principal : to the principal + its interest. Whence the amount of any given principal for any given number of years, and at any rate per cent , may be found as follows (for the sake of expedition, we extract an example from Wingate) :—

Take 300*l.* at 5 per cent., then

$$100 : 105 : : \left| \begin{array}{ll} 300 & : 315 \\ 315 & : 330.75 \\ 330.75 & : 347.2875 \\ 347.2875 & : 364.651875 \end{array} \right.$$

which gives the amount of 300*l.*, and its interest at the end of 1, 2, 3, and 4 years respectively.

But the principal and the several amounts are a series of numbers in geometrical progression, increasing in proportion as 100 to 105, or as 1 to 1.05. This will appear from their production, or may be proved from the equality of the products of any extreme and mean terms. Now the amounts of 1*l.* for any number of years, at any rate per cent., will be the powers of the amount of 1*l.* for one year. Therefore, if the powers of the amount of 1*l.* for one year be first calculated, the amount of any principal may be found by multiplication only. Thus, if the powers of 1.05 (5 per cent.) be computed, they, with their indexes, will be as follows :—

0	1	2	3	4, &c., indexes.
1.	1.05.	1.1025.	1.57625.	1.21550625, &c., powers.

and the amount of 300*l.* in four years at 5 per cent., will be the products of 1.21550625, the fourth power of 1.05, multiplied by the principal 300*l*., which gives 364,65187500.

In the example mentioned by our correspondent, the small fractional parts are omitted for brevity; 1.48024 is nearer, but it is troublesome to operate with so many decimal figures. The multiplication of decimals is in no respect different from that of whole numbers, only care must be taken to point off the proper number of figures in the product; that is to say, as many as there are places of decimals in the two quantities to be multiplied. Thus 1.04 × 1.04

$$\begin{array}{r} 1.04 \\ 1.04 \\ \hline 416 \\ 104 \\ \hline 1.0816 \end{array}$$

In which case four figures are pointed off for decimals, there being 4 decimal figures in the multiplyer and multiplicand togesher, that is, two in each.—Ed.]

REMARKABLE RAIN.

It has often been asserted, and as often contradicted, that at various times frogs have been observed to descend in rain; and the testimony by which many such relations are supported, proceeds from sources too respectable to be rashly rejected, notwithstanding the danger of producing indigestion in the organs of belief. This subject was discussed a short time ago in the Academy of Sciences in Paris, but the learned members did not unanimously agree, though the prevailing opinion appeared to be supported by careful and repeated observations. When the young frogs, passing from the tadpole state, first assume the honours of quadruped, they quit the water, and conceal themselves in holes and crevices, under stones or elsewhere, according to the nature of the locality; when the rain penetrates into these recesses, the frogs come out, and their sudden appearance while the rain is falling suggests the idea that they fall with the rain. We frequently observe snow, dust, and other light particles of matter, carried away by the wind and deposited at a considerable distance; and it is well known that those concentrated storms called water-spouts, or whirlwinds, will frequently take up considerable quantities of water and other heavy substances; but if frogs were raised up in this manner, they would be accom-

panied with mud, and other impurities in the water. A curious account of a shower of mud is given in a French publication, called the "Journal de Physique;" it occurred near Uldina, and is thus described and commented upon by De Fortis:—

"The wind had blown with violence from the east for three days. The extent of country which was abundantly besprinkled by this strange rain, was twelve miles in diameter from the borders of the sea to the bottom of the Alps of Carnia. I do not know whether the partisans of the opinion which makes lava come to us from the moon, can derive any arguments in their favour from the mud which has covered the plains of Friouli; but, for my part, I first imagined that the wind, being charged in Sicili, or near Naples, with clouds of volcanic dust, had deposited them at the bottom of the Carnian mountains, which prevented the clouds from going further. But having then observed, through a very powerful magnifying glass, a specimen of the sediment in question which a friend sent me from Udina, I convinced myself that it had not the least resemblance to that *detritus* which is raised by volcanos to the superior regions of the atmosphere. It appears to me more natural to suppose that a storm, or perhaps water-spouts at sea, having sucked up some of the muddy water which the rivers by their inundation leave on the plains, raised them to the upper regions, where they were carried away by the winds. It is in consequence of similar circumstances, very natural and common, that worms, tadpoles, and small fishes, have often been seen to fall from the clouds with rain, without any person conceiving the idea of making them come from an aerial race or from another globe."

THE CHEMIST.

GALVANISM.

(*Continued from page* 359.)

53. When compounds, consisting of bodies which have been arranged under the same class of electro-negatives or electro-positives, undergo decomposition, one of them is found to be electro-positive or electro-negative, in reference to the other. Thus oxygen, which is an electro-negative (as before observed in the last experiment), is combined with any other electro-negative substance, is always separated at the positive pole; and potassium, which is an electro-positive body, if combined with any other electro-positive substance, always appears at the negative pole. Oxygen is the most electro-negative, and potassium the most electro-positive of all known bodies.

54. It is known that the poisonous effects of copper may be prevented by a film of tin. The explanation of this fact is this,—the tin is opposite with respect to the copper, and therefore preserves the copper from being acted on by any acid matter, which, being *negative*, will not act on the *positive* tin.

55. An application of galvanism is to toxicology, in the detection of bichloride of mercury. For this purpose, we have merely to let fall a drop of the solution on the surface of a piece of gold, and then to bring a piece of iron in contact with both. A galvanic circle is thus formed, and as the iron is *positive*, the acid will be transferred to it, and the mercury will be deposited on the gold.

56. The electric organ of the torpedo, the gymnotus electricus, &c., seems to be constructed like a galvanic battery, for it consists of little laminæ, or pellicles, arranged in columns, and separated by moisture.

57. The energy of galvanism as a medical agent, remains yet to be investigated; but when we consider the effects which a very small quantity of this power produces on the muscles of an animal, even after it has been deprived of life, it would not be thought unreasonable to predict, that a current of electricity sent for a considerable time through a diseased part, may be productive of the best effects.

58. From the discovery of the above curious effect, it was inferred, that the source of nervous influence was electricity. Dr. W. Phillip ascertained by experiment, that when a nerve is divided, so as to intercept the transmission of its action, the place of the nerve may be supplied by a galvanic apparatus.

59. He divided the eigth pair of nerves which are distributed to the stomach, and are subservient to digestion, by incisions in the necks of several living rabbits. After the operation, the parsley which they ate remained without alteration in their stomachs, and the animals, after evincing much difficulty of breathing, seemed to die of suffocation. When, in other rabbits similarly treated, the galvanic power was distributed along the nerve below its section to a disc of silver, placed closely in contact with the skin of the animal opposite its stomach, no difficulty of breathing occurred. The electrical action having been kept up for twenty-

six hours, the animals were killed, and the parsley was found in as perfectly digested state, as that in healthy rabbits fed at the same time, and their stomachs evolved the smell peculiar to that of a rabbit during digestion.

60. But the most extraordinary effects of a galvanic battery, are the chemical effects and modifications produced by it on the parts concerned, or as such as are placed in the circuit, and this circumstance led, in the hands of Sir H. Davy, to the most important discoveries.

61. Of all the forces which counteract attraction, and of course subvert combination, galvanism is the most energetic, and as, by enlarging the apparatus producing it, it may be accumulated to any degree of intensity, there is, apparently, no limitation to its power. Chemistry has thus been put in possession of an agent more powerful than any which it before possessed, and the most splendid discoveries have been effected by its application.

62. Thus Sir Humphrey Davy, led by the knowledge of the law by which the agency of this power in producing decomposition is regulated, submitted to its action a number of substances, the composition of which, previously to this, was entirely unknown. The application was successful; the chemical constitution of the alkalies, earths, and certain acids, has been established, and a series of substances discovered, which were before entirely unknown.

63. Among the classes of chemical agents, the alkalies and earths are strictly connected by their general powers, and they possess in particular to the same extent, the most important property by which they are characterized.

64. The leading property distinctive of the alkalies, is displayed in their relations to the acids; these two classes are in a measure opposed to each other in entering into combination. The acids diminish the alkaline properties, the alkalies are equally subversive of the acids, and, when united in certain proportions, the properties of neither appear in the compound. The same agency is excited by the earths and metallic oxides. Thus in the most important chemical character of these substances that are displayed in their relation acids, the alkalies, earths, and metallic to oxydes, are strictly connected, and the constitutions of the last being known, analogy would have led to the conclusion, that the others are of a similar nature, or that the earth and alkalies consist of metallic bases combined with oxygen.

65. At length the discoveries of Sir Humphrey Davy have fully established the analogy, and have demonstrately proved that they consist of metallic bases combined with oxygen.

66. The experiment which exhibited to this great chemist the decomposition of one of the fixed alkalies, is thus described by himself:—A small piece of pure potash, sufficiently moistened by the atmosphere to give a conducting power to the surface, was placed upon an insulated disc of platina connected with the negative side of the battery in a state of intense activity, and a platina wire communicating with the positive side, was brought into contact with the upper surface of the alkali. Under these circumstances, a vivid action was soon observed to take place; the potass began to fuse at both its points of electricative. There was a violent effervescence at the upper surface; at the lower or negative surface there was no liberation of elastic fluid, but small globules, having a high metallic lustre, and being precisely similar in visible characters to mercury, appeared; some of these burnt with an explosion and bright flame as soon as they were formed, and others that remained were tarnished, and finally covered by a white film which formed on their surfaces.

67. By these analytical experiments, potass is proved to be accompanied by a peculiar substance, highly inflammable, and having metallic lustre and oxygen. The metallic base has been named by the discoverer *potassium*.

68. The neutral salts may be decomposed in the following manner:—Place three watch-glasses parallel with each other, and connect them together with filaments of moistened cotton; in the two outer glasses place an infusion of litmus, and in the centre one, a few crystals of sulphate of soda and water; connect the former with the poles of the battery. In a short time the salt in the centre will have undergone decomposition, the sulphuric acid will collect in the glass connected with the *positive* end, and the alkali will pass into the *negative* cup, changing the blue infusion to a green.

69. The galvanic battery being applied to lime, strontites, and barytes, in the same manner as it had been applied to the alkalies, a decomposition was observed to take place, gas was evolved, and metallic globules were produced at the negative wires.

70. I shall now, in conclusion, touch slightly on the theories of galvanic electricity. In Volta's hypotheses, which has

received the name of the electrical theory, the electricity of the pile is considered to be the result of the contact of the metals, and that the interposed pieces of moistened flannel, act simply as imperfect conductors for the transmission of the fluid from one pair of plates to the other. This theory (by many considered inaccurate) has been modified by Sir H. Davy, and called by him the electro-chemical theory of galvanism. The next is that of Dr. Wollatson, called the chemical theory. In this the electricity of the pile is supposed to be derived from chemical action in the oxidizement of the metals employed. This theory premises, that no chemical action takes place without a transfer of electricity. In the simple galvanic circle, the zinc is chemically acted upon, the water supplying the oxygen to the zinc forming the oxide of that metal, the latter being dissolved by the free acid in the solution. In this case the zinc acquires a negative electrical state, as regards the solution, which is in the opposite or positive state.

71. Sir H. Davy in his theory, endeavours to combine the two preceding, viz., the electrical theory of Volta, and the chemical theory of Dr. Wollaston. In this it is presumed, that in addition to the disturbance of the electric equilibrium by contact, as laid down by Volta, Wollaston's theory is added, inasmuch, that the chemical changes contribute to the general results, and further, that all bodies, whether in combination or not, possess inherently different states of electric power or energy, some being naturally *negative*, as I before stated, as oxygen, chlorine, iodine, and the acids; others, on the contrary, being naturally *positive*, as hydrogen, sulphur, and the metals that the union of bodies chemically may be referred to these opposite states, and as some of them are very dissimilar, so are the elements of the compound more closely united.

The object of these papers is to give the readers of your instructive little work, a sketch of the general laws and facts of galvanic electricity; and if they have been useful to any of your readers, the end of the writer is fully answered.

J. MITCHELL.

Scarborough Railway.—We understand that Mr. Stephenson, the eminent engineer, and his assistants, are now engaged in surveying for a line of railway from York to Scarborough. It has been matter of wonder to us, that this undertaking should have been so long deferred, especially considering, besides the great facilities which the bay affords for making Scarborough an extensive shipping port, that the proposed railway in connexion with the York and North Midland, the Great North of England, the Leeds and Selby, the Leeds and Manchester, and the Leeds and Bradford Railways, will open out a rapid steam communication with the whole length and breadth of the land. It is gratifying also to learn, that the arrangements for prosecuting the Leeds and Bradford Railway in the next session of Parliament are progressing satisfactorily.—*Leeds Intelligencer.*

London and Croydon Railway.—At a special general meeting of the proprietors, it was stated, in the director's report, that the number of the passengers from the day of opening (5th of June last) to the 16th of August, was 141,677, averaging about 14,00 per week, the amount of money received, was 8,246*l.* 12*s.* 2*d.*, making an average of a little more than 800*l.* per week.

Manchester and Leeds Railway.—The following communication from Mr. T. W. Robinson, has appeared in the *Railway Times*:—"I beg to state the result of work done by the 'Stephenson' engine on this line, by way of testing her powers on the worst gradients between Manchester and Leeds, viz., from the Manchester viaduct to the Reywood branch canal, a distance of seven miles and a quarter, and a gradient of one in 150. This engine took up a train with 694 passengers, besides guards, free passes, enginemen, &c., in twenty-five minutes,—five of which she stopped at the Mills Hill station—having to regain her speed on this steep incline, which she did with great ease, going the whole distance at an average of twenty-two miles per hour. The 'Stephenson' is a six-wheel engine, with fourteen-inch cylinder and eighteen-inch stroke, made by Messrs. Robert Stephenson and Co., of Newcastle-on-Tyne,—which are the principal dimensions of all the engines used on this line, on which the traffic is rapidly increasing, amounting at present to upwards of 3000 passengers per day, and so soon as the Company are prepared to carry goods it will be immense. The system of booking passengers adopted, the invention of Mr. Edmondson, the Company's check clerk, is most admirable, as may be gathered from the fact, that one clerk books all the passengers at Manchester station, and 694 were ticketed in fourteen minutes; and at the intermediate station of Rochdale, as many as 455 have been booked and put in the carriages in three minutes."

Edinburgh and Glasgow Railway.—The contractors on the above line of railway are proceeding with their respective contracts in a manner highly satisfactorily to the Directors. The tremendous tunnel at the head of Queen-street is getting on rapidly, and the workmen are at the present time excavating the solid rock underneath the Lunatic Asylum. It is said that the tunnel will be about *three miles* in length.—*Glasgow Courier.*

Virtues of Tea.—In the travels of J. Albert de Mandelso, in 1638, speaking of his manner of living at Surat, he says, "At our ordinary meetings every day we took only Thé, which is commonly used all over the Indies, not only among those of the country, but also among the Dutch

and English, who take it as a drug that cleanseth the stomach and digests the superfluous humours by a temperate heat peculiar thereto. The Persians, instead of Thé, drink their Kahwa, which cools and abates the natural heat which The preserves."

Muscular Powers of Insects, &c.—Among the insect tribe, a wonderful diversity of muscular powers are discovered; there are many species which unite in themselves all the powers of motion which are possessed by the superior animals separately. They can walk, run, swim, or fly, with as much ease as quadrupeds, birds, and fishes. Such a combined medley of locomotive functions must require an equal diversity of motive power, and such is the fact In the mere larva of the caterpillar, when in a state approaching to a butterfly, Lyonet has discovered not less that 4061 distinct muscles, which is about ten times the number that belong to the human body; and it is probable that, when the insect arrives at its perfect state, the number will be much greater. The phosphorescent springer, a winged insect, has the extraordinary power that, when laid on its back, it can spring up half a foot in order to recover its position. This insect, also, secretes a light, so much stronger than the common glow-worm, that a person may see to read small print with it at midnight. Crabbs and spiders can throw off an entire limb, when seized by it, in order to make their escape. The land crab travels once a year from the woods which it inhabits to the sea, to deposit its spawn, which sinks into the sands at the bottom of the sea After a short time, millions of little crabs thus hatched, are seen quitting their native element, and making their way to the woods. The hinge of the common oyster is a single muscle, and that belonging to the great clam-fish is no more. This animal is of the oyster kind, and has been taken in the Indian ocean of a weight not less than 532 pounds, sufficient to furnish five hundred men with a meal. It is able, by the means of this single muscle, to cut off the hand of a man, or snap asunder the cable of a large ship.

Stage Coaches in 1706—The following copy of a printed card, framed and glazed, is preserved in the bar of the Black Swan at York:—" The York four-day's coach begins on Friday the 12th of April, 1706. All that are desirous to pass from London to York, and from York, or any other place on that road, in this expeditious manner, let them repair to the Black Swan in Holborn, in London; and to the Black Swan in Coney-street, York. At both places they may be received in a stage coach every Monday, Wednesday, and Friday, which actually performs the *whole journey in the short space of four days* (if God permit). The coach sets forth at five o'clock in the morning, and returns from York to Stamford, by Huntingdon to London, in two days more, allowing passengers 14 lb. weight, and all above, three-pence per pound."

Ancient Inscription at Pistoja.—At one of the meetings of the French Academy in July last, a letter was read from M. Roulin on the subject of an inscription which he had observed on the front of the church at Pistoja, and in which is found a date which he transcribes thus,—MCIXVI; this he conceived to be meant for 1196; the symbol IX, which signifies 9 in the Roman notation, representing 90 on account of its position. When this communication was read, M. Libri thought it might have been an error, either in the reading or in the inscription itself; he now announces that the inscription has been examined, at his request, by M. Mori, professor at Pistoja, and it has been ascertained, that the character which had been taken for I in the symbol expressing the tenths, is really an L, not in that form, but like an I, projecting a little above the other letters, a form which was frequently employed at that period. The inscription must, therefore, be read 1166, which presents no anomaly, and agrees with the reading of Ciampi and Cicoguara.

The late Sir Walter Scott.—A monument of the late Sir Walter Scott, raised by subscription, was erected at Selkirk on the 15th ult., the poet's birth day. The statue is seven feet and a half high, and a striking likeness. Sir Walter, who was Sheriff of the county for thirty-two years, is in the costume of the Sheriff, with a roll of paper in his rigqt hand, resting on his trusty staff.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, September 18, G. F. Richardson, Esq., on the Geology of the South-east of England (in conclusion. Friday, Sept. 20, R. H. Semple, Esq., M R.C.S., on the Nature and Properties of Poisons. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Sept. 19th, G. F. Richardson, Esq., on Geology (in conclusion). At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Sept. 17th, H. B. Paull, Esq., on Language. Institution opens at 6.

QUERIES.

Receipts for various colours of paint, the proper proportions for mixing, and how? 2. For various colours of dyeing, black in particular? 3. To make hydrochloric acid gas? 4. Nitrous oxide, or laughing gas? 5. Carbonic acid gas? 6. Detonating powders? A good water cement? 7. Salt of lemons to take out ink stains? 8. Parchment transparent? 9. Iron soft when cold? 10. To remove grease spots from clothes? 11. To make an electrical machine, the corresponding dimensions; likewise where I may purchase everything necessary for the same?

HENRY.

If a fly-wheel of a steam-engine be put in rapid motion, and the engine and all its connexion be suddenly liberated from it, would the fly-wheel increase for any short period of time its velocity?

J. G.

[Certainly not; the instant the maintaining power is removed, the retardation commences; but it is imperceptible during the first few seconds.—ED.]

"1. T. Z." (page 360) would much oblige me by stating in your next number, where such naptha can be bought, and at what price; and how much of the naptha will dissolve a pound of India-rubber? I have bought naptha at a very high price, five shillings a quart, which did not dissolve the India-rubber under a month, and then it was good for nothing.

2. Recipe for making the rings used for parasols; they appear to be a bone reduced into paste, and then moulded?

3. The composition of the varnish used for paper, such as cards, &c., and which is so very fine. F. P. H. T.

ANSWERS TO QUERIES.

To join Steel to Iron.—No. 40. It is Shear steel which is generally welded to iron for most cutting instruments, and not cast steel. There is a peculiar kind of cast steel which is made for the purpose of welding to iron; but it is only made at some particular places. Any kind of cast steel may be welded to iron by carefully heating the end you intend to weld, three or four times to a melting heat, and slacking it each time separately in cold water. You may then weld them together like two pieces of iron. T. Z.

To find the Distance of a Planet.—The distance of a planet is obtained from its horizontal parallax, which is equal to an angle formed by two lines drawn from the centre of the planet's disc, the one to the centre of the earth, the other to a point on its surface, and of course meeting the diameter at a right angle, the sine of which parallax is to the earth's semi-diameter as radius to the planet's distance. If "Melck Ric" should be acquainted with trigonometry, we will enter into detail in a future correspondence, and illustrate with diagram and examples. Should he not have made it his study, and should be desirous of doing so, he will find it very clearly explained in a cheap little treatise published by Relfe and Fletcher, on a box of instruments and the slide rule, a work of varied information in a small space, and written professedly for schools and mechanics. For the present we may merely state, that the sun's parallax is 8″ 36‴, the sine of which is .0000416939, &c.; divide 3982, the earth's radius, by this, and we have somewhat more than 95 millions of miles. We await "Melck Ric's" reply. W. W.

To make Red Ink.—"A. B." will find the following receipt, taken from the "British Cyclopædia of the Arts and Sciences," a good one:—"A quarter of a pound of the best log-wood is boiled with an ounce of powdered alum, and the same quantity of cream of tartar, with half the quantity of water, and while the preparation is still warm, sugar and good gum-arabic, of each one ounce, are dissolved in it." Proportio.

To make French polish for furniture, and naptha polish? F. Persent.
Hatton Wall.

The Density of the Earth.—Query 6. The density of the earth is stated by La Place to be 4.95, that of water being 1. Hence, putting d, diameter of the earth, and w, weight of a cubic mile of water, the formula expressing the earth's density will be $2.5918wd^3$.

Specific Gravity of Alcohol.—(C. H.) The circumstance that the specific gravity of alcohol is less than that of water, is no reason that a mixture of the two should not be a denser liquid than either. This will depend solely upon the resulting bulk. Suppose, for instance, two pints of any liquid should weigh 5 pounds, and two of another 4 pounds; the relative gravity of the first will be $2\frac{1}{2}$, of the second, 2; mixing these together we obtain 9 pounds. If now there are four pints, the gravity will of course be $2\frac{1}{4}$; but if a diminution of bulk take place, and the mixture make but three pints, the gravity will be 3. As to the evolution of heat, this is but a natural consequence of the diminished bulk. In chemical combinations, diminution of bulk and consequent augmented density, are always attended with the evolution of heat, and, conversely, with increased bulk, and consequent diminished density, cold is produced. Compression is but a peculiar form of friction, of which the first is an instance.

To Remove Hair from the Skin.—We would recommend "A Constant Purchaser," to use "Rowland's Depilatory," having removed a quantity of hair with it three or four years back, which has never returned. The mixture is laid on wet, to the thickness of a quarter of an inch, and allowed to remain fifteen or twenty minutes. It is apt to remove the skin in places, but that *does* grow again. Lime is the principal ingredient. W. W.

"N. P. R." is informed, that I have two superior lathes to sell at a very low price, fit to turn both wood and metal. Apply to J. Munyard, 2, Tanner's Hill, Deptford.

A "Constant Reader,' No. 165, may procure bituminous lava (alias asphalte) at two shillings per firkin, from Cassell's, Mill Wall, Poplar, which is the cheapest I have heard of yet, and as good as any. All the other patentees would, I have no doubt, sell him any quantity.

"Gullilmus," can procure a parlour printing press very reasonable at Holtzapfell's, 64, Charing-cross. W. P. C.

TO CORRESPONDENTS.

W. P. C. *We accept his offer, and feel much indebted to his kindness. The errors he alludes to shall be rectified, and their recurrence as far as possible prevented.*

T. C. *We have not seen the "anatomized flowers and leaves" to which he alludes; if he means the fibrous skeletons of leaves which are sometimes spontaneously produced by exposure to moisture, they may be artificially made by drying the leaves, and beating them with a brush on the edge of a large book.*

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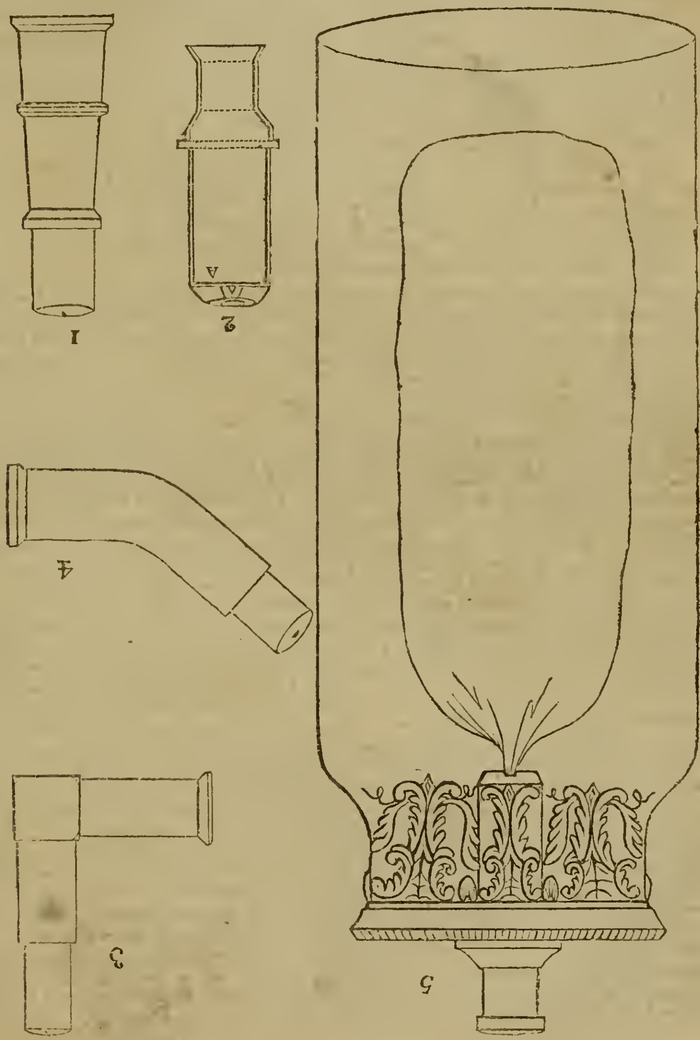
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. XLVIII. & XLIX. NEW SERIES.	SATURDAY, SEPT. 21, 1839. (PRICE TWO PENCE.)	Nos. CLXIX. & CLXX. OLD SERIES.

DOCKREE'S TWO-HOLE GAS-BURNER.



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OPTICAL INSTRUMENTS.

NO. II.

ON PLANE BURNING MIRRORS.

A COMBINATION of plane burning mirrors forms a powerful burning instrument; and it is highly probable that it was with such a combination that Archimedes destroyed the ships of Marcellus. Athanasius Kircher, who first proved the efficacy of a union of plane mirrors, went with his pupil Scheiner to Syracuse, to examine the position of the hostile fleet, and they were both satisfied that the ships of Marcellus could not have been more than *thirty* paces distant from Archimedes. Buffon constructed a burning apparatus upon this principle, which is easily explained. If we reflect the light of the sun upon one cheek by a small piece of plane looking-glass, we shall experience a sensation of heat less than if the direct rays of the sun fell upon it. If with the other hand we reflect the sun's light upon the same cheek with another piece of mirror, the warmth will be increased, and so on, till with five or six pieces we can no longer endure the heat. Buffon combined 168 pieces of mirror, six inches by 8, so that he could, by a little mechanism connected with each, cause them to reflect the light of the sun upon one spot. Those pieces of glass were selected which gave the smallest image of the sun at 250 feet.

The following were the effects produced by some of these mirrors :—

No. of Mirrors.	Distance of Objects.	Effects produced.
12	...... 20 feet	Small combustibles burned.
40	 66	Tarred beech plank inflamed.
45	 20	Pewter flask six pounds weight melted.
98	 126	Tarred and sulphured plank set on fire.
117	 20	Some thin pieces of silver melted.
154	 250	Chips of deal sulphured set on fire.
224	 40	Plates of silver melted.

As it is difficult to adjust the mirrors while the sun changes its place, M. Peyrard proposed to produce great effects by mounting each mirror in a separate frame, carrying a telescope, by means of which one person can direct the reflected rays to the object which is to be burnt. He conceived, that with 590 glasses about twenty inches in diameter, he could reduce a fleet to ashes at the distance of a quarter of a league, and with glasses of double that size at the distance of half a league. Plane glass mirrors have been combined permanently into a parabolic form, for the purpose of burning objects placed in the focus of the parabola, by the sun's rays; and the same combination has been used, and is still in use, for lighting reflectors, the light being placed in the focus of the parabola.

CONVEX AND CONCAVE MIRRORS.

Convex mirrors are used principally as ornaments, and are characterized by their property of forming erect and diminished images of all objects placed before them, and these images appear to be situated behind the mirror. Concave mirrors are distinguished by their property of forming in front of them, and in the air, inverted images of erect objects, or erect images of inverted objects, placed at some distance beyond their principal focus. If a fine transparent cloud of blue smoke is raised by means of a chafing-dish, around the focus of a large concave mirror, the image of any highly illuminated object will be depicted in the middle of it with great beauty. A skull concealed from the observer, is sometimes used to surprise the ignorant; and when a dish of fruit has been depicted in this manner, a spectator stretching out his hand to seize it, is met with the image of a drawn dagger, which has been quickly substituted for the fruit at the other conjugate focus of the mirror. Concave mirrors have been used as lighthouse reflectors, and as burning instruments. When used in lighthouses, they are formed of plates of copper plated with silver, and they are hammered into a parabolic form, and then polished with the hand. A lamp placed in the focus of the parabola, will have its divergent light thrown, after reflection, into something like a parallel beam, which will retain its intensity at a great distance. When concave mirrors are used for burning, they are generally made spherical, and regularly ground, and polished on a tool, like the specula used in telescopes. The most celebrated of these were made by M. Villele, of Lyons, who executed five large ones. One of the best of them, which consisted of copper and tin, was very nearly four feet in diameter, and its focal length thirty-eight inches. It melted a piece of Pompey's pillar in fifty seconds, a silver sixpence in seven seconds and a half, a halfpenny in sixteen seconds, cast iron in sixteen seconds, slate in three seconds, and thin tile in four seconds.

CYLINDRICAL MIRRORS.

All objects seen by reflection in a cylindrical mirror, are necessarily distorted. If an observer looks into such a mirror with its axis standing vertically, he will see the image of his head of the same length as the original, because the surface of the mirror is a straight line in a vertical direction. The breadth of the face will be greatly contracted in a horizontal direction, because the surface is very convex in that direction, and in intermediate directions the head will have intermediate breadths. If the axis of the mirror is held horizontally, the face will be as broad as life, and exceedingly short. If a picture or portrait is laid down horizontally before the mirror, the reflected image of it will be highly distorted; but the picture may be drawn distorted according to regular laws, so that its image shall have the most correct proportions. Cylindrical mirrors, which are now very uncommon, used to be made for this purpose, and were accompanied with a series of distorted figures, which, when seen by the eye, have neither shape nor meaning, but when laid down before a cylindrical mirror, the reflected image of them has the most perfect proportions.

A. D. M.

LOCOMOTIVE TRAVELLING.

On Monday Mr. Coles delivered his second lecture on Locomotive Travelling, at the Mechanics' Institution, in presence of many civil engineers, machinists, and scientific gentlemen, when he exhibited, as before, his circular railroad, and a new step-rail; and showed, by working models, the important advantages of anti-friction machinery where speed or power was wanted. The lecturer commenced by showing the necessity of all four-wheel carriages being made to move on pivots in the centre of their axles, instead of being fixed and immovable, as at present constructed. He then showed that the off-wheels of an ordinary railway-carriage, when working round a circle of twenty-three yards radius, would lose ten inches and a half every revolution they made, even when working on moveable axles, and they could not make many revolutions upon any curve without running foul of the rails, and thus the engine would have to contend with an enormous amount of friction; one-half of the wheels of each train would press with their flanges against the rails, as also an increase of friction in the bearings of the axles, by the wheels being thrown obliquely in their bearings. To obviate which, he introduced models of a new step-rail, which may be made of cast-iron, thus:—An indention or step is sunk down on the inner edge of the rail about one-third its width, and half an inch deep in the highest, and about three quarters in the lowest part. The step of the rail for working curves would be so low down as never to come in contact with the rim of the wheel in working straight lines, nor when working the inner curve. The flange, or largest part of the off wheel, runs entirely on the step, or raised part of the rail, when working a curve of twenty-three yards radius; but, if working a curve of twice that size, it would work one half on the plain side of the rail, and the other half on the step, which would be undulated, having hills and valleys of equal distance, by which the wheels would run parallel with each other, and thus work clear of the rails, and cause no side friction; and rails may thus be formed to suit any curve. The principle of securing the rail to its bearings is both novel and ingenious, and which is particularly described in an essay on locomotive travelling. The lecturer then demonstrated more fully his principle of the traversing axles of the four-wheel carriages, from which it appeared manifest that, by fixing a stout iron bar to the collars or bearings of the axles, the wheels being outside the frames, such bars would work up and down the grooves with their collars, whilst their axles would revolve in their collars as before, and to these bars two other bars would be attached, something in the shape of a quadrant, which meet each other between the two axles, and form a union or knuckle-joint, each part would be operated upon by the rail, and thrown diagonally with their wheels into right angles with the curve of the rails, room being allowed in the grooves in which the wheels work, to admit of their moving backwards or forwards. The point of resistance is thus transferred from the sides of the carriage-frame to the pivots in the cross-stays on which the axle-bars move; two loops would be attached on the edge of all the axle-bars, about five inches each side of their centre; the bars being wider than the cross-stays, two bolts or keys would pass through these loops to key them together, and keep them perpendicularly over each other, that they shall all move in the same direction. He next elucidated the foregoing principle on the traversing axles, by exhibiting to the audience a four-wheel locomotive, with the axles placed into the frame diagonally to such

an angle as was required to work round a circular iron railway 34 feet 6 inches in circumference, the off-wheels being seven-eighths of an inch larger in the periphery of the wheels than the inner wheels, which is precisely the same thing as if the periphery of the wheels had been turned both of a size and the flange left on. The rail and carriages being made on a scale of one inch to the foot. A two-wheel carriage laden very heavy was attached to the locomotive, and when set in motion they traversed round the circle in five seconds, or at the comparative rate of fifty miles in an hour. He next explained the nature of working them by manual labour, and showed, that by fixing a handle to a spoke of the large anti-friction, or driving wheel, they may be propelled with immense velocity, the friction being transferred from the ground wheels, which revolve 75 times, to the upper wheels, which only revolve once, thereby proving that there would be scarcely any wear in the working wheels. He next exhibited a four-wheel carriage, on which a man could propel himself by turning the wheels as he sat upon it. Mr. Coles then placed 168 lbs. weight upon the carriage, and placed it upon a level iron plane, and attached a six-ounce weight and brought it over a pulley which propelled it; the weight was then taken off, and the common wheels were employed, and the aforesaid load of 168 lbs. placed upon it, and it required eight times greater power, viz., 48 ounces, to propel it; thus clearly demonstrating, that one pound power is equal to eight pounds now on railways, or 64 lbs. on the common roads; the advantages are of a like proportion if employed on the common roads, and this increase of power is gained by the reduction of friction in the axles alone, leaving for future experiments to show what friction remains to be got rid of between the flanges of the wheels and the rails. The lecturer farther showed, that his patent anti-friction machinery is about to be applied to vessels, for which he has also a more recent patent, and the combined force of manual labour and steam may be employed, without the use of cog or crank, of which a specimen will shortly appear at the Hungerford-stairs, in a handsome barge.

LAUNCH OF THE EAST INDIA COMPANY'S ARMED STEAMER, SESOSTRIS.

The launch of this beautiful vessel took place on Tuesday from the dock-yard of Mr. Pitcher, at Northfleet. The *Sesostris* is a first-class vessel, built by order of the East India Company, for the express purpose of protecting their trade in the Indian seas. She is a magnificent boat, of the best order of naval architecture, and is altogether worthy of the important post assigned her. At eleven o'clock the directors and their friends left Fresh Wharf, London Bridge, in the *Star*, Gravesend steamer, which had been engaged for their accommodation. On its arrival at Rosherville Pier, the company on board disembarked for the purpose of visiting the Kent Zoological and Botanical Gardens, in the immediate neighbourhood of the dock-yard, from which the launch was to take place. Here they were received by Mr. Lutwyche, Mr. Jones, and Mr. Thornton, the directors and manager of the Kent Gardens Company, by whom the visitors were conducted over the whole of the grounds. The directors expressed both surprise and admiration at the progress lately made. Indeed these gardens merit the support of the public at large; for, in addition to almost unequalled natural beauties, art and taste have done much to render this one of the most attractive spots on the banks of the Thames. At half-past two the company were summoned from the gardens to witness the launch, every thing being in readiness by that time. On our arrival in the dock-yard, we found it literally filled with respectable people anxious to get a view of the sight; while the walls and trees in the immediate neighbourhood were covered at every point with a humbler, but not less excited class of spectators. Immediately on the arrival of the directors, the signal was given, and the *Sesostris* breasted the stream in silent but impressive dignity. The general opinion amongst the naval men assembled to witness the launch, seemed to be, that the vessel was of a superior order of naval architecture, and well adapted to the object for which she was constructed. Shortly after the launch was over, the directors and their friends returned to Blackwall, where a sumptuous entertainment was provided at Lovegrove's, the Brunswick Hotel, over which Sir Richard Jenkins, G.C.B., M.P., presided. After the usual loyal toasts were given, the Chairman, in proposing the health of Captain Moresly, the skilful and experienced officer to whom the directors had entrusted the command of the *Sesostris*, took occasion to call attention to the importance of affording perfect security to the trade with India by means of armed steamers. The engines for the *Sesostris*, manufactured by Maudsley and Field, are

quite ready for fixing, and it is the intention of the Company to forward her without loss of time to her destination.—*London Paper.*

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 342.)

Winslow, eight miles from Leighton Buzzard station, 51 miles from London, is a small market town of little trade, boasting of considerable antiquity, but possessing few reliques to amuse the antiquarian, or interest the historian.

Woburn, eight miles from the Leighton Buzzard station, 41½ from London, is a neat market town in Bedfordshire, bordering on Buckinghamshire; it consists chiefly of one street on the road from Dunstable to Ampthill. In 1724 this town was almost wholly destroyed by fire; and its present symmetrical appearance may be attributed, in a great measure, to the simultaneous rebuilding of a great portion after that distressing event. The church dedicated to St. Mary, was erected by Robert Hobbs, the last abbot of Woburn. It originally belonged to the Abbey, and is still of exempt jurisdiction, being in the exclusive possession of the Duke of Bedford. This church was constructed on a very singular plan; the body was completely detached from the tower, which stood about six yards distant. The tower is a small square building, with large buttresses at the corners, and four pinnacles. The top is embrasured; the dial, till recently, was not more than about nine feet from the ground, but it is now removed to a height sufficient to protect it from injury, and a connexion is formed between the tower and the body of the church.

The neighbourhood of Woburn affords an abundant supply of fuller's earth, an article of much importance in preparing woollen cloths. This earth is superior in quality to that of any other country, and laws have been made at different periods, prohibiting its exportation. It is commonly of a greyish brown, but is sometimes found of various tints, from a pale ash colour, to a dark brown, approaching to black. From the surface of the earth to the depth of six or seven feet, are layers of reddish sand of different tints; beneath which is a thin stratum of sand stone, and under this is the fuller's earth, disposed in layers about eighteen inches thick; they are separated by a thin lamina of a substance which in taste, colour, and appearance, very much resembles terra japonica. Woburn is also celebrated for a certain spring which is said to exist, or to have existed, at some period in its vicinity, possessing the power of petrifaction, or converting different substances into stone. There appears, however, to be much exaggeration in the wonderful accounts of this water, which are found in various books. It is well known that there are many springs whose waters possess the property of depositing a stoney substance on the surface of bodies exposed a long time to their action, which gives them the appearance of stone; and geological researches have shown that bodies of organic origin, have, after remaining buried for mauy ages, assumed the appearance and properties of minerals, and entirely abandoned those substances which originally constituted or characterized animal or vegetable organization; but it does not appear that any spring or water iu existence, is capable of operating this transmutation in any period short enough to admit of observation. Water has always been, and is still, a favourite object of superstitious fantasies; Alonso Barba gives an account of some petrifying waters of Peru, which greatly exceed all those we have in Europe, in the quantity of stoney matter they coutain. He asserts that they soon choak up their own passage, by the stoney matter they deposit there; and that all the cattle that drink of them die. He relates another story, which is about as indigestible to the mind, as the water is said to be to the cattle; he says that they have moulds of the shape of our bricks, which they fill with this wonderful water, and that on being exposed to the sun a few days, the water is wholly converted into a stone of the same shape, and that they employ them for constructing their houses and other buildings. Mauy will, no doubt, believe this, and even regret that it is not still more marvellous, so that they might have an opportunity of displaying the full power of their credulity; for the ingenuity of man never yet invented a story so extravagant and absurd, but believers were found willing and eager to swallow it. Opinious being very various and contradictory on the subject of petrifyiug waters, renders it an excellent subject for a traveller to introduce in cold weather; for its discussion usually leads to a broil, and a good fierce quarrel is the best substitute for fire when the thermometer is low.

Woburn Abbey, the seat of the Duke of Bedford, is situated in an extensive park, about a mile from the town. It oc-

cupies the site of a Cistercian Abbey, which was granted by Edward VI., with many other ecclesiastical estates, to John, afterwards Lord Russell. The present mansion is an extensive and magnificent edifice, of a quadrangular form; the principal front facing the west, is of the Ionic order, with a rusticated basement. The interior is superbly decorated, and enriched with valuable paintings. From the Duke's apartments on the south side of the building, a covered way leads to a gallery, containing a rich collection of antique and modern works of art, amongst which the most conspicuous is the great Lanti Vase, which, with many others, was brought by Lord Cawdor, from the Vatican at Rome, and purchased by the Duke for 1700 guineas. It is of the bell shape, and appears to have been consecrated to Bacchus, being decorated with eight finely sculptured bacchanalian marks. It is supposed to have been used as a laver, or as a symbol only of this part of the heathen mythology; for connoisseurs are of opinion that no wine was ever poured into it. It was dug up, some centuries ago, among the ruins of Adrian's Villa, together with the fragments of three other vases of nearly similar dimensions. This, and one at Warwick Castle, which is still more elaborately decorated, are the only complete antique vases, of the same dimensions, extant; it is above six feet in diameter, and near seven feet in height.

The origin of the greatness of the Bedford family, was in the reign of Henry VII., when Philip, Archduke of Austria, met with a Mr. Russell, at Weymouth, who had been taught to speak German, and being pleased with his manners, the Duke recommended him to the King, who placed him in that road to preferment, which, by prudent management, led to the acquisition of enormous riches, and placed his posterity in a position to inclose a pleasure-ground at Woburn, *twelve miles in circumference!*—This is what called "*otium cum dignitate.*"

A short excavation, preserving the same inclination which it had previous to reaching the Leighton Buzzard station (that is, a gradual descent), arrives at the Linslade Tunnel, 290 yards in length, and above 50 feet below the surface of the earth: 20,433 cubic feet of earth were taken from it. After the tunnel is a small cutting 61 feet deep, succeeded by an embankment over a deep valley; the view from this point is interesting, but not extensive. The Grand Junction Canal lies placidly about 10 feet beneath its more boisterous and vigorous rival; on the east is Linslade Wood, a fox-cover, where much glory has often been acquired by a resolute army of dogs, horses, and men, giving battle to and vanquishing a fox. A little further on, a view is obtained of Linslade Church and Linslade House. The village was formerly celebrated for a certain well, the water of which was supposed to be holy; but the mistake was afterwards discovered, and the bishop of Lincoln cited the vicar of the church to appear in his court for having encouraged pilgrimages and processions thereto, for his own emolument. Liscombe House, a seat of the Lovatt family, is about two miles distant, but obscured by the high grounds and trees with which it is surrounded.

(To be continued.)

A CURE FOR DEAFNESS.

If any mode of proof can establish the certainty of a fact as completely as absolute rational demonstration, the evidence of our senses in actual experiment must rank with the most perfect and satisfactory testimonies which the mind can desire. It is not our intention to entangle ourselves in the controversy between Dr. Turnbull and his opponents, or to calculate the influence of jealousy on the one hand, and of mystery on the other; but to relate what we have seen, and what any one interested in the subject may see, by paying a morning visit to Dr. Turnbull at his residence in Russel-square. Upon the occasion of our visit, there were present several medical gentlemen of eminence, who examined the patients very closely, both by questions and by inspection; the hearing of each person was tested in various ways; the ticking of a watch placed at different distances from the ear is recommended by the Doctor as most convenient; but the simplest, and perhaps the most satisfactory is the voice, since the patient's answer is an undeniable proof that he really hears. Several persons declared that they had been afflicted with deafness during periods of ten, twelve, and fifteen years, and proved by their answers, that they had recovered their hearing, and they affirmed that they had been submitted to the treatment of Dr. Turnbull but a very short time; one, a young woman, had become deaf through taking a quantity of arsenic, which nearly caused her death; her hearing was completely restored by a few applications. Several persons who had been born deaf and dumb, were so far restored as to repeat the words which were spoken in a loud

voice near to the ear; but they did not appear to understand their meaning. It would be tedious to describe, or even to enumerate the many cases we investigated, but it is important to remark, that they all agreed that the application (which in most cases is the introduction of some liquid into the orifice of the ear) produced no pain, or other inconvenience, which is a strong recommendation to Dr. Turnbull's method. At all events we may fairly advise those who are suffering from deafness, to go to Russell-square and judge for themselves. The following notice of Dr. Turnbull is from a work entitled "Physic and Physicians:"—

"Dr. Alexander Turnbull is a physician who has contributed much to the alleviation of human suffering. He commenced practice in the year 1815, in the city of Carlisle, where he obtained considerable fame and patronage. He remained there for five years; when, after visiting Edinburgh, and obtaining his degree of M.D., he in the year 1832, came to the metropolis, took the house in Russell-square, which had been previously occupied by Dr. Armstrong, and commenced the career of a London physician. Possessing an enquiring and reflecting mind, he directed his attention to the relief of those painful nervous affections, which so often baffle the skill of the most eminent in the profession, and which diseases may be said to constitute to a certain extent the *opprobria* of our art."

"In 1834, Dr. Turnbull discovered the extraordinary efficacy of *veratria* in certain forms of neuralgia. Prior to this period it was the generally-received opinion that this powerful agent had active aperient qualities. M. Magendie, the celebrated French physiologist, states, in all the editions of his "Formulary," that veratria is principally serviceable in cases where it is desirable to effect a prompt effort from the bowels. How Magendie could have been so deceived, it is not in our power to say, but it is evident he knew nothing of the real efficacy of this powerful agent. To Dr. Turnbull belongs the honour of having introduced to the notice of the public this valuable preparation; and the profession now generally admit its curative properties, when internally and externally used in tic douloureux, rheumatism, gout, and all forms of neuralgic diseases.'—(Vide Dr. Turnbull on "Painful and Nervous Diseases," p. 7, third edition.)

"Dr. Turnbull has directed much of his attention to the diseases of the ear; and has succeeded in discovering some remedies which appear to act instantaneously on that organ, by removing all impediments to the healthy exercise of its functions. When it is evident that the disease arises from an affection of the nerve, we have seen immediate good result from the use of his application. We have been particular in investigating some extraordinary cases of deafness, which have been treated successfully by this physician, because, when related, they appear almost incredible; and we feel much pleasure in testifying to Dr. Turnbull's fairness, absence of all mystery, and willingness to permit every circumstance connected with the patients under his care, to be thoroughly sifted.

"At present it is not known what the remedies are which Dr. T. has discovered, and which have such extraordinary efficacy; but we feel assured that so soon as the doctor has matured his views, and brought to a conclusion the series of experiments in which he is now engaged, he will make known to the medical public the result of his unwearied, laborious, and patient researches, and thus remove any suspicions which the profession may feel disposed to entertain, in consequence of the remedial agents which he employs being known only to himself. It would be doing Dr. T. a great injury to disclose, prematurely, the discovery he has made. The matter is as yet only *sub judice*. The experiments are far from being finished—much has yet to be done before his views can be laid with any degree of satisfaction before the public. Hitherto (and we speak from personal observation) the result has exceeded his most sanguine expectations. The most apparently obstinate cases of deafness appear to be incapable of resisting the potency of the application which is used; and what at first sight astonishes the most is, that the effect is instantaneous. We have seen cases in which the defect was so great, as to prevent the patient from hearing the ticking of a watch when pressed closely to the ear, and yet, in a few minutes after the application was made, the sound was audible to the person when the watch was held two yards from him.

"But the most extraordinary cures which this physician has been enabled to effect we have yet to mention. Dr. T. has for some years been engaged in a series of experiments respecting the treatment of children born deaf and dumb; and he has so far matured his discoveries, that he has succeded in restoring a number of children to a healthy use of the organs of speech and hearing, who had been

pronounced by other members of the faculty as incurable. We have, in the presence of many distinguished individuals, had the gratification of witnessing the process which the doctor has recourse to, and we can vouch for the triumphant success which attends his noble efforts to relieve the sufferings of his fellow-creatures. We have seen no less than two hundred patients at Dr. Turnbull's house in Russell-square in one morning, many of them of course gratuitous. He is unremitting in his attention to the most humble of his patients.

"Dr. Turnbull's manners are extremely gentlemanly and engaging. His knowledge is by no means confined to his profession; his mind appears to be generally well informed on all subjects. We do not hesitate in affirming, that if merit has its just reward, this physician will one day hold a proud rank among the medical philosophers of his day; and he will be considered as having done much to diminish the amount of human affliction, and to enlarge the boundaries of medical science."

EGYPTIAN BATHS.

Scarcely had I entered, when two strong men belonging to the bath laid hold of me, and in an instant I was stripped to the skin. One of them then passed a linen shawl around my waist, while the other fastened on my feet a pair of gigantic pattens, which at once made me a foot taller. This mode of shoeing not only rendered flight impossible, but, by its clumsy elevation, destroyed my equillibrium; and I should inevitably have fallen had not the two men supported me on either side. I was fairly caught. We passed into another room; here the vapour and heat stifled me. I thought my guides had mistaken the way, and got into an oven. I tried to shake them off, but my resistance was anticipated. In a few moments I was astonished at perceiving that, as the perspiration poured from me, my lungs began to dilate, and my respiration returned. In this state I passed through five or six rooms, the heat of which increased so rapidly that I began to believe that man had for five thousand years been mistaking his proper element, and that his appropriate destiny was boiling or roasting. At last we came to the stove-room. There the fog was so dense that I could not see two steps before me, and the heat so entirely insupportable, that I partly fainted. I shut my eyes, and resigned myself to my guides. After leading, or rather carrying me a few steps farther, they took off my girdle, unhooked my pattens, and extended me, half swooning, on something like a marble table, in the middle of the apartment. Here, again, I soon became accustomed to the infernal atmosphere. With my other senses, my sight revived; and, despite the fog, I made out, with tolerable accuracy, the surrounding objects. My tormentors seemed to have forgotten me for a moment; they were busy at one side of the room. I lay in the centre of a large square saloon, incrusted, to the height of five or six feet, with variously-coloured marbles. A series of spouts threw out incessantly streams of steaming water, which, falling on the pavement beneath, glided thence into four basins, like cauldrons, at the four corners of the room. On the surface of the water in these basins was an indefinite number of bald heads bobbing about, and expressing, by the most grotesque contortions of face, various degrees of felicity. This spectacle so occupied my attention, that I scarcely heeded the return of my masters. They came, however, one with a large wooden bowl of soap-suds, the other with a ball of fine flax. Suddenly one of the rascals inundated my face and neck with his suds; and the other, seizing me by the shoulder, rubbed most furiously my face and breast with his flax. This treatment, and the pain induced by it, were so perfectly intolerable, that all my powers of resistance and resentment waked at once. I bolted upright, kicked my flaxen friend half across the room, and planted my fist in the face of soap-suds with such good-will that he lay sprawling on the floor. Then, knowing of no other remedy for the soap (which was blistering my skin), I boldly plunged into the larger basin. I had misjudged, the remedy was worse than the disease. Before my face and neck were cauterized, now my whole body was scalded: the water was boiling. I yelled with pain; sprang on and over my neighbours, who could not comprehend my case; and got out of the tub almost as rapidly as I got in. However, I was not rapid enough to escape the effect of the ablution; my body was as red as a lobster. I was stupefied; I must be dreaming, or riding a nightmare. Yet there was no deception. Here, under my very eyes, were men stewing in a broth of which I had tried the temperature, who evidently took great delight in the operation. I determined again to submit to my tormentors. They came, having recovered from my assault. I followed them without resistance to another

basin. They made signs to me to descend the steps: I obeyed...... From this I passed to another of a higher temperature, but still supportable. I remained in it, as in the first, about three minutes. I then proceeded to the third, which was still some ten or twelve degrees hotter; and, finally, reached the fourth, where I had commenced my hellish apprenticeship. I approached it with the greatest repugnance; but I had made up my mind to go through with my desperate adventure. I first dipped my toe in the water; it was hot, certainly, but not so scalding as before. I gradually immersed my whole body, and was surprised to find it endurable.... My attendants now again took me in hand. They replaced the linen around my waist, bound a shawl on my head, and led me back through the rooms by which I had entered (taking care to add to my covering at each change of atmosphere) until I arrived at the chamber where I was so unceremoniously stripped. Here I found a good carpet and pillow. My turban and girdle were taken off; I was enveloped in a large woollen gown, laid down like an infant, and left alone. I had now an undefinable feeling of comfort. I was perfectly happy; yet so exhausted, that when the door was opened, half an hour after, I had not changed my position by the movement of a finger or a muscle. The new comer was a sinewy and well-set Arab. He approached my couch as if he had some business with me. I looked on him with a sort of dread, very natural to a man who had passed such an ordeal as I have described; but I was too weak to attempt to rise. He took my left hand, cracked all its joints, and did the same to the right. After my hands, he administered upon my feet and knees; and, to finish the matter, he dexterously threw me into the position of a pigeon to be broiled, and gave me a *coup de grace* by cracking the vertebræ of my spine. I screamed with terror, thinking my backbone was broken to a certainty. My *masseur* then kneaded my arms, legs, and thighs for a quarter of an hour, and left me. I was weaker than ever; my joints all pained me, and I had not strength sufficient to cover myself with the carpet. A servant now brought me coffee, pastiles, and a pipe; and left me to intoxicate myself with perfumes and tobacco. I passed half an hour in a drowsy state, lost in the vagaries of a delicious inebriation, experiencing a feeling of happiness before unknown, and entertaining a supreme indifference to every (absent) earthly thing. I was awakened from this by a barber, who shaved me, and combed my whiskers and moustachios. Next, my Arab returned, to whom I made signs that I wished to depart. He brought my clothes, assisted me in my toilet, and led me to the chamber opening on the vestibule, where I found my cloak. The cost of this entertainment, which lasted three hours, was a piastre and a half, or eleven sous of our money.—*From the French of M. Dumas.*

DOCKREE'S TWO-HOLE GAS-BURNER.

(See engraving, front page.)

In recommending this burner to the notice of the public, we wish it to be distinguished from the hundreds of ingenious little contrivances which, though deserving praise and encouragement, cannot be considered as permanently beneficial to society. Simple as the apparatus of Mr. Dockree may appear, we do not hesitate in pronouncing it a very valuable discovery. The principle is entirely new, but may soon be understood. Every one who has attended to the regulation of a gas-burner, must have observed that a certain pressure is required to produce a bright and steady flame; and an increase of that pressure will not only affect the quantity of gas given out, but very materially derange the steadiness and brightness of the flame, and generate a great quantity of smoke. It is evident that this effect is not produced by the increased discharge of gas, but by the increased force with which it is projected; this is proved by the result of Mr. Dockree's experiments. Fig. 2 is a section of the burner, having two holes, A A, pointing obliquely, so that the two streams of gas, meeting each other in the centre, mutually impede each other in the direction of their currents, and destroy the force which in a common burner hurries away the gas to a great distance before it is consumed, and a considerable portion mixes with the atmosphere, and is lost. Fig. 5 represents the appearance of the flame at a moderate pressure; when the gas is turned on so as to cause the flame of a common burner to rise up and smoke, the only effect observed in the flame from Mr. Dockree's burner, is that it spreads a little farther at right angles to the holes, and gives a brighter light; but *no smoke is ever perceptible.*

Figs. 1, 3 and 4, are different forms of burners adapted to various purposes; fig. 4 is chiefly employed by printers, and is already introduced into several great establishments. The economy of this burner

is no doubt considerable, Mr. Dockree says it is thirty-five per cent.

The manufactory is at No. 16, Galway Street, City Road, where any person wishing to see the effect, will obtain ample satisfaction from the inventor.

THE ANTARCTIC EXPEDITION.

About the beginning of this week this very interesting expedition left the British shores. Had it been possible to complete the extensive philosophical and other equipments in a shorter space of time, it would have been better, perhaps, had it been able to sail six weeks or two months earlier; but still its course is open, and the delay will lead to no other consequence than some slight alteration in the projected plan of operations.

On Tuesday se'nnight, the Terror, Captain Crozier, dropped down from off the dockyard at Chatham, to Gillingham, with all her white canvass spread, and looking like a bird of passage preparing to wing its way to another clime; and on Thursday, or as soon after as possible, her companion, the Erebus, Captain James Clark Ross, was appointed to follow, and then proceed on their voyage together. Having gone to take our farewell, a short description of the vessels, &c., cannot be unacceptable to our readers.

The Erebus and Terror seem to be twin ships, alike in build, colours, masts, and rigging, and, indeed, in every external appearance. An inexperienced eye could not tell the one from the other. The Erebus is about 370 tons, the Terror 340. In each the full complement of officers and men is sixty-four, a hundred and twenty-eight in all.* Nothing that the art of a shipwright could accomplish, has been omitted to fit them for their perilous undertaking. Below, not only have the ribs been strengthened by transverse timbers, but these again have been interlaced by cross beams at certain angles, so as to offer resistance to any invading body, such as ice, which would require a mighty force to overcome. Thus, internally powerful beyond all former example, the outward hull has also been so shaped (curving from near the centre, something like the turning-off edge of a glass or tea-cup) as to throw the converging ice from the chain-plates, and thus protect the rigging from being crushed or invaded. The deck, too, is double; and the whole has a compactness and firmness which gives assurance of security from the worst elements to which their gallant crews can ever be exposed. A spare rudder, which could be shipped in case of accident to the other, is safely stowed amidships; each vessel is provided with eight boats, two of them whalers, and framed to encounter rough seas and weather in separate expeditions, to explore passages and lands where the ships cannot penetrate. Six guns are borne in each, viz. four six-pounders and two salute-guns. The apparatus for keeping the vessel at an equable temperature is admirable, and consists of a square iron tube, above a foot in diameter, running all round the sides, and distributing a comfortable warmth to every berth in the ship. The ventilation is not less attended to. There are also stoves in the captains' cabins, and the gun-room messes † which adjoin; and the cooking conveniences are as ample and fit for every purpose as they could be on shore. There is a large kettle to dissolve ice into fresh water, another for dressing salt meat, another for fish, another for fresh meat, and ovens for baking. The mates' cabins are well constructed, and those for the officers to sleep in, though small, are arranged with all a seaman's skill and dexterity in making much of a little. The sick berths are forward, and so contrived that the invalids may be kept apart from the healthy, for their own sakes as well as for the general safety. Immense ice-saws are ranged along the lower deck; some of them thirty, or more, feet long, and looking like the jaws of sharks, competent to cut through any besetting adversary.

They are victualled with fresh provisions for three years, and pemmacan and prepared meats in cases are stowed away in the least possible compass.

The provision of scientific instruments, under the superintendence of the Royal Society, is very complete; and double sets, to supply the loss of any which may be broken or rendered useless, seem almost to furnish the commander's cabin. In this respect the Admiralty has been most liberal; and, indeed, we may say, that after the first official difficulties were got over, the Government has taken up the expedi-

* *Erebus*—Captain, J. C. Ross. Lieutenants, E. T. Bird, J. F. L. Wood, J. Sibbard. Master, H. Mapleton. Surgeon, R. M'Cormick. Purser, T. R. Hallett. Assistant-Surgeon, J. D. Hooker.
Terror—Captain, F. R. M. Crozier. Lieutenants, A. M'Murdo, J. H. Kay. Master, P. P. Cotter. Surgeon, J. Robertson. Assistant-surgeon, D. Lyall.

† In these, four officers will be accommocated; the fifth keeping the deck.

tion with the most commendable spirit, and done everything that can contribute to its successful issue. The phenomena of terrestrial magnetism will be independently observed throughout the voyage; and also in connexion with the new observations about to be established, as already stated in the *Literary Gazette*, at St. Helens, the Cape, Van Diemen's Land, &c. The declination, inclination, and intensity of the magnet, will thus form tables of the utmost importance towards solving this great problem. The declination instrument, the horizontal and the vertical force magneto-meters, are constructed under the direction of Professor Lloyd, of Dublin; and there are, besides dip circles, transits, with azimuth circles, and chronometers of the most approved construction. There are also pendulums for ascertaining the true figure of the earth, thermometers for determining the temperature of the sea at different depths; other blackened thermometers to measure the atmospheric temperature in different latitudes; photometric sensitive paper for experiments on light; barometers to be observed during storms, white squalls, &c.; glasses for sidereal observations particularly on the variable stars, α Hydræ and η Argus); drawing utensils; repositories for geological, botanical, and natural history specimens; actinometers for finding the forces of solar and terrestrial radiation; hygrometers, Osler's anemometers, rain-guages, electrometers, skeleton registers of every needful kind; and, in short, such means to employ, and so much to be done, that there will be no great leisure for our enterprising countrymen when all these instruments are put in requisition, and their results are regularly chronicled for the information of the world.

In looking over the vessels about to depart on so deeply interesting an occasion, many slight matters and incidents touch the feelings. In almost every cabin and berth were tolerable collections of books; and Captain Ross's amounted to a fair library of the most useful description. In some were sweet remembranees of native land, in prints and pictures; and one engraving, conspicuous in the gallant Commander's cabin, affected us much—it was of "Our Saviour walking on the Waters!" Faith and Hope could not have chosen a more beautiful illustration of the sailor's mind; the instruments of the soul, without the possession of which, what were all that the philosophy and science of man could provide? In that engraving alone, we read a more certain index of the success of this great work, than in the multitude of ingenious machines, and the volumes of the wise instructions, by which our most estimable friend was surrounded.

Some kind heart had supplied a twelfth-cake, to be opened on the 6th January, 1840! The diameter of the globe will then be between the giver and the receiver.

Another pleasant circumstance to record, is the friendship subsisting between Captains Ross and Crozier. They have been messmates, and intimate together. Crozier was a midshipman in the ship where Ross was a lieutenant; he was a leutenant where Ross was captain; and now he is captain where Rois is commodore of the expedition. They have served together, know and regard each other, and this is an auspicious promise for their mutual good understanding and cordial co-operation to the end; when bound together in their brave barks—

"To reside
In thrilling regions of thick-ribbed ice,
To be imprisoned in the viewless winds,
And blown [we trust not] with restless violence
round about the pendant world."

The earlier proceedings of the voyage will lead them to St. Helens, where Lieutenant Eardley Wilmot, of the Royal Engineers, who goes out in the *Erebus*, will be left in charge of the new observatory. Next, at the Cape, will be landed for the like purpose, another officer. The vessels then make their way across the ocean, touching at and examining Kergueland's Land, Amsterdam and other islands, either known, or imperfectly reported in that vast expanse of water. Arrived at Van Diemen's Land, the instruments, &c., for the observatory will be sent ashore, and whilst it is erecting, they will cruize to various points where the scientific pursuits of the expedition are most likely to be advanced. On their return they will start *de novo* in a direct southern course, between 120 and 160 deg. east long., towards the Antarctic Pole; and it is a singular and fortunate thing, that in this direction, during the present season, a ship of Mr. Enderby's has discovered land on both sides of the longitudes we have indicated, in about 65 and 68 deg. of south latitude.* These shores have been named Sabrina Land, seen March, 1839; and Balleny Isle, seen February, 1839; and

* Of these recent discoveries in the southern hemisphere, Mr. Bates, of the Poultry, has just published an excellent chart, under the superintendence of Captain Beaufort. They appear like the pillars of a gateway, between which the Expedition should pass.—*Ed. L. G.*

between them, as well as upon them, the efforts of the Erebus and Terror will, in the first instance, be employed. How far they may penetrate is in the hands of Providence. They will afterwards circumnavigate the Pole, and try in every quarter to reach the highest point, whether near Enderby's Land, discovered in 1832, or by Captain Weddell's furthest reach, about 73 deg., in 1823.

It is between Sabrina Land and Balleny Isle, to the northward, in about lat. 50 deg., and E. long. 140 deg., that it is expected the south magnetic pole will be found. Strange if he who discovered either that of the North, or so near an approach to it as Captain James Ross did, should also ascertain this long-sought phenomenon. We had forgotten to mention that the vessels are constructed on the plan which divides them into three compartments; so that either extremity or middle might be stove in, and yet the remainder be a safe hold for the crew.*

Wherever the voyagers go, we have only to add, may God bless and prosper them, and return them in safety to a grateful country, and their anxious relatives and friends!—*Literary Gazette.*

* The *Kentish Gazette* states, that "the wales are doubled with 8-inch oak plank, and the bottom with plank of three inches; the holds, the ceilings of which are doubled with thicknesses of $1\frac{1}{2}$-inch African teak, crossing each other at right angles; the bulkheads in the holds are built in like manner, and made water-tight; so that, should the bottom be stove in at any part by the sheets of ice, the safety of the ships will not be endangered. The pumps fitted are those of Massie's patent. The weather deck is also doubled with 3-inch fir plank, with fearnought, dipped in tallow, laid between them."

PENNY POSTAGE.

To the Editor of the Mechanic and Chemist.

Sir,—Your kind offer, contained in "The Mechanic and Chemist," of the 14th instant, to uphold the priority of any plan that may be suggested by any of your readers, induces me to submit the two following to your notice.

Previous to my entering into detail, I will state a few objections which seem likely to occur in adopting the envelopes proposed by Mr. Hill.

In how many instances are letters produced to prove the justice or injustice of a number of objects which arise in the course of litigation, but more especially as to dates of certain transactions; and how easy, for fraudulent purposes, to alter the date, or substitute another letter of more recent or more remote date, as may serve best for the occasion; which, being inclosed in the envelope used in some other correspondence, may be produced as evidence of a different nature to what it ought; and if those envelopes should be stamped with some particular mark or date, so much the better for purposes of imposition: but this could only be done after the letter was put in the post-office, and as it is but reasonable to suppose that a great increase of correspondence will take place on the reduction of the postage, it must greatly increase the labour of those employed in it, and cause a greater liability to error.

On the other hand, if no stamp is made use of at the post-office, any individual having an extensive correspondence with another, may exchange the envelopes, at certain intervals, and make use of them in future correspondence, and thus defraud the revenue to a serious extent.

The first plan I propose, is to obviate the grievances which the wholesale and retail stationers say they shall labour under, and to leave the matter free from any monopoly, which is as follows:—that any manufacturer, stationer, or private individual, shall be at liberty to send any quantity of paper he thinks proper, to some place appointed, for the purpose of being stamped, at their own risk hereafter, on the payment of 1*d.* for each sheet, if above a certain weight, 2*d.* or 3*d.*, as the case may require. Such stamped paper to be sold in the regular course of trade, always changing the rate of postage in addition to the usual price of the paper; each stamp to be placed on the back of the sheet, or that side opposite the one on which the words "Bath post," &c., are usually impressed (that being generally the commencement of a letter (and so situated, that it shall be as near as possible to the centre of the letter when folded in the usual manner, but always conspicuous, or not transmittable by post.

The second is, that a room be provided adjoining the Post-office, or as near as convenient, with two doors, one opposite the other. That a counter or table sufficiently broad be placed the whole length, leaving a sufficient space for the accommodation of the public. That a certain number of boards be fixed in the room on which is painted in conspicuous characters, the hours of arrival and departure of the different mails, together with any other information which may be thought necessary. That a stamp be provided of

any determined form, on which the name of the place, amount of postage paid, and the date be attached. That the stamp be considered a sufficient evidence of the dates of all letters produced to decide any matter of doubt, and that all others transmittable by post, which do not bear the said stamp, be null and void. That a certain number of clerks be provided for the purpose of affixing the stamps, which constitutes the whole of the requisites for my purpose. The objects I propose by my plan, is to reduce the system into as simple a form as possible. The removal of an immense quantity of labour from the Post-office, thereby expediting the transmitting of letters.

The certainty of receiving the postage, and giving satisfaction to the public at large, by enabling each one to make use of what description of paper he thinks best adapted to his purpose.

I shall now pursue a letter through all the stages necessary, making a few observations as I proceed, which I think will be sufficient to explain my present views.

On arriving at the Stamping-room, I present my letter and the amount of postage to one of the clerks at the counter, who impresses the stamp on the front of it with one blow, and then returns it to me. If desirous of information respecting the mails, I refer to the tables, which prevents the clerk from leaving his work. I now proceed to the Post-office, leaving the room by the opposite door to the one I entered, which prevents any inconvenience to others coming in. Being now deposited in the Post-office, it is only necessary to be counted and put in the proper bag ready for the mail, which is all that is necessary for those engaged to do, as all questions are answered and marks attached to the letters in the Stamping-room. Another advantage attending the room on my plan is, that any number of clerks may be employed, and a sufficient check kept upon the receipts, by counting the number of letters put in the Post-office, and comparing them with the amount of money received in the Stamping-room.

I am Sir, yours, &c.

J. Halliday.

Derby-street, Manchester.

Sailing on Railroads.—A Dutch paper states, that a man employed on the Haarlem and Amsterdam railroad, fitted up one of the carriages, a few days back with sails, and profiting by a favourable wind, started with several passengers, and arrived at Amsterdam in a very short time, without any other propelling power than the wind.

THE CHEMIST.

ACIDS.

NO. I.

Most of the acids are substances which produce that sensation on the tongue which we call *sour*; but some substances are classed with the acids which have not this characteristic, though they possess some of the other qualities of acids. Acids change the vegetable blues to red, and combine with the alkalies, earths, or metallic oxides, and form compounds called salts. Most of the acids owe their origin to the combination of certain substances with oxygen, which was formerly called the acidifying principle. Many of these bodies may be decomposed by combustible bodies. Any combustible body that has a greater affinity for oxygen than oxygen has for the base or radical of the acid, will decompose that acid. Charcoal, when made red hot, will in this way decompose sulphuric acid. Some of the acidifiable radicals combine with different proportions of oxygen, which produces different stages of acidity. Thus when two acids have the same radical, but contain different quantities of oxygen, they are distinguished by their termination. The name of that which contains most oxygen, ends in *ic*, the other in *ous*; for instance, we say *sulphuric* and *sulphurous*, and *phosphoric* and *phosphorous* acid. In the following papers I shall give the process for preparing most of the acids and their properties.

Acetic Acid.—To obtain acetic acid, or, as it has been called *radical vinegar*, distilled vinegar may be saturated with some metallic oxide, and the acetate thus obtained subsequently decomposed; acetic acid is thus procured, by distilling acetate of copper, or chrystallized verdigris, in a glass retort heated gradually to redness. It requires redistillation to free it from a little oxide of copper, which passes over in the first instance. Acetic acid may also be obtained, by distilling acetate of soda or acetate of lead, with half its weight of sulphuric acid. A considerable quantity of acetic acid is now procured by distillation of wood in the process of preparing charcoal for the manufacture of gunpowder. The liquid, when first procured, is generally termed *pyrolignous acid*; it is empyreumatic and impure, and several processes have been contrived to free it from tar and other extraneous matters which it contains. It may be saturated with chalk and evaporated, by which an impure acetate of lime will be obtained, and which, mixed with sulphate of soda,

furnishes by double decomposition, sulphate of lime and acetate of soda; the latter, distilled with sulphuric acid, affords a nearly pure acetic acid; obtained by these processes, is transparent and colourless; its odour highly pungent; it blisters and excoriates when applied to the skin. It is extremely volatile, and its vapour burns readily. It combines in all proportions with water. When highly concentrated, its specific gravity is about 1.060; it chrystallizes at the temperature of 40°. In this state it is called *glacial acetic acid*; and accordingly to Berzelius, whose analysis of acetic acid was very carefully conducted, its ultimate components are,

Carbon	46.83
Oxygen	46.82
Hydrogen	6.35
	100.

Guy Lussac and Thenard, from the analysis of acetate of baryta, estimate the ultimate components of acetic acid as follows:—

Carbon	50.224
Oxygen	44.147
Hydrogen	5.629
	100.

Acetic acid forms a class of salts called *acetates*, with various bases.

Amniotic Acid.—The amniotic acid was obtained by Vanquelin and his coadjutor Buniva. In order to obtain it nothing more is necessary than to evaporate the liquor of the amnios of the cow to one-fourth, and leave the remainder to cool, which will be found to contain the acid in crystals. It is slightly acid, and reddens the tincture of turnsole. It is scarcely soluble in cold water, though very readily in hot. It is incapable of decomposing the alkaline cartorates, but unites with the pure alkalies, and with them forms neutral salts.

Arsenious Acid can be obtained by the combustion of metallic arsenic. It is the white arsenic of commerce; it is a hard brittle substance, with a glassy texture. It forms a class of salts termed *arsenites*.

Arsenic Acid is obtained by distilling a mixture of four parts of muriatic acid and twenty-four of nitric acid off eight parts of arsenious acid, gradually raising the bottom of the retort to a dull red heat at the end of the operation. It may also be procured by distilling nitric acid off powdered metallic arsenic. Arsenic acid is a white substance, of a sour taste; it is deliquescent and uncrystallizable. Its specific gravity is 3·4. It requires for solution six parts of cold water and two of boiling water; its solution reddens vegetable blues, tastes acid and metallic. Heated to bright redness it evolves oxygen, and is converted into arsenious acid. With the different bases it forms salts called *arseniates*.

Aspartic Acid may be formed by digesting asparagin in a mixture of hydrated protoxide of lead and water. The acid is thus obtained in prismatic crystals, difficultly soluble in cold water, and insoluble in alcohol. It may be decomposed by sulphuretted hydrogen. It combines with bases, and forms salts called *aspartates*.

Benzoic Acid may be obtained by sublimation from benzoin, which is a resinous exudation from the *Benzie Myrax* of Sumatra. It also exists in the balsams of Tolu and Peru. If these substances be heated in a crucible, with a cone of paper attached to its mouth, the acid condenses in fine annular crystals, which were formerly called flowers of benzoin. It may also be obtained by boiling a pound-and-a-half of benzoin with four ounces of quick lime in eight quarts of water. When cold the clear liquor is decantered, and the residuum again boiled in half the former quantity of water. The liquors thus obtained are boiled down to half their bulk, filtered, and mixed with muriatic acid, as long as it occasions a precipitate, from which the liquor is poured off, and when dry is put into an earthen vessel, placed in a sand heat, and sublimed into paper cones. A very good process for procuring this acid is that recommended by Mr. Hatchett, which consists in digesting benzoin in sulphuric acid, when it affords, on the application of heat, a copious sublimate of pure benzoic acid. Benzoic acid, when it has been thus sublimed, is in the form of soft feathery crystals, very inflammable, fusible at about 230 degrees, and of a specific gravity of about ·67; of an acrid and slightly sour taste, soluble in 25 or 30 parts of boiling water. It is much more soluble in alcohol, and this solution easily furnishes it pure and in prysmatic crystals. It is soluble without immediate change, in nitric and sulphuric acids, and in many other acids, by the aid of heat. Berzelius' analysis gives the following as the components of this acid:—

Hydrogen	5·16
Carbon	74·41
Oxygen	20·43
	100

It forms a class of salts called *benzoates*.

J. Mitchell.

Death of Professor Wilkins.—This gentleman died at his house near Cambridge on Saturday the 31st ult., in the 61st year of his age. He was Professor of Architecture of the Royal Academy, and had long a high reputation founded on his earlier works, especially the College of Corpus Christi, and his additions to that of King's, at Cambridge. This, however, had been much damaged by his National Gallery, in London. He had also greatly distinguished himself by his literary productions—the translation of Vitravises, &c. In all the relations of private life, he was most amiable; and the combined qualities of his head and heart obtained for him the friendship and sincere attachment of men in the highest walks of literature and fame.

Bats.—Naturalists have remarked a beautiful arrangement of a provisional character in the case of bats. These animals fly chiefly during the night, and build their nests in the inner recesses of dark caverns; they must, therefore, be able to direct themselves through the air by another sense than that of seeing. It has been found, that if the eyes of bats are destroyed altogether, and leather glued over their sockets, and even if their ears and nostrils be at the same time rendered useless, they will still continue to direct their flight as well as before, and avoid in their course through the air the smallest threads and other objects hung up to intercept them. They can likewise thread the mazes of a cavern without hurting themselves on the walls, and in this state of total blindness and deafness, and destitute of the power of smelling, they will go directly to their nest holes. The provision in this instance appears to be in the sense of touch. The fine membranes of the wings have such a delicacy of touch, that by this means alone, in its passage through the air, the animal becomes aware of the proximity of objects, which it takes care to avoid.

Number of Plants.—According to Humboldt, the species of plants at present known, amount to 44,000. Of these, 6000 have neither blossoms nor visible fructification; the remaining 38,000 are those which have visible organs of fructification, and are thus distributed:—In Europe, 7000; temperate regions of Asia, 1500; Asia, within the tropics, and its islands, 4500; Africa, 3000; both the temperate regions of America, 4000; in America between the tropics, 13,000; New Holland, and the islands of the Pacific, 5000.

Pyramids.—Of all nations, the Egyptians seem to have built and planned with the most exclusive regard to permanence. They designed to make antiquities. A dim bewildered instinct, a yearning after immortality, was the chief object of all their undertakings. They preferred an unconscious existence, in the form of hideous mummies, to utter dissolution. Huge piles of brick or stone, with square bases and triangular sides, were reared by slaves for tyrants to moulder in—standing evidences of heartless pride, and heart-withering debasement—ponderous burdens heaped on mother earth to defraud her of her due. The Greeks built for beauty, the Romans for magnificence, the Orientals for barbaric splendour, the Chinese for fantastic finery, the Gothic nations for the sublimity of religious effect, or martial strength; a Dutchman builds to please himself, a sensible Englishman for convenience, others of that nation to show their wealth or taste; but the Egyptian built in defiance of time, or rather propitiated that ruthless power, by erecting him altars whereon to inscribe his victories over all beside.—*Literary Almanack.* ALPHA.

Lengthening a Steam Vessel.—A curious operation took place in Chatham Dock-yard last week, that of lengthening the *Gleaner* steam-vessel, which had been taken into dock for that purpose. She was sawn in two a little more than one-third of her length from her stern, and ways were laid from the fore part of her to tread on, the purchase falls were rove, and brought to two capstans, and the order being given by the master shipwright, the men hove away, and in five minutes the fore section was separated from the after part a distance of 18 feet. The space between will now be filled up by new timber. There is no record of any ship or vessel having been lengthened in this dock-yard before the *Gleaner.*—*Kentish Paper.*

Discovery of Human Skeletons.—In the course of the last week the men employed in excavating the ground in the New Market, for the purpose of constructing a new culvert to carry off the water from the intended depôt of the Gloucester and Birmingham Railway, discovered at the depth of some feet, two dozen skeletons. They were generally in a perfect state, and the teeth in some of the skulls were quite white. It is supposed that they are the remains of some of the soldiers who fell in battle in 1643, when Charles the First besieged the city, the spot where they were found being near to the north gate, around which, it appears from the history of Gloucester, there was great carnage. The skeletons were lying in various directions, and the ground near apparently contains many others; we understand there were several found near the same spot some years ago, when alterations were being made. A military button, upon which there is the figure 9 surmounted with a crown, and in the usual part the maker's name, "C. Jennens, London," has also been found, together with a spur, and a horse's skull in a decayed state. Most of the skeletons have been re-buried, and the others will be as the excavation is filled up.—*Gloucester Chronicle.*

Manufacture of Potash.—A vast quantity of this substance is annually made in Canada, and exported to Great Britain. Potashes are made from the ashes of burnt trees. In burning timber to clear the land, the ashes are carefully preserved, and put in barrels, or other vessels, with holes in the bottom; and water being poured over them, a liquid or alkali is run off; this ley being boiled in large boilers, the watery particles evaporate, and leave what is called black salts, a sort of residuum, which, when heated to a high degree, becomes fused, and, finally, when cool, assumes the character of potash. By these potashes the Canadians make their own soap; the ley of a barrel of ashes, boiled along with ten pounds of tallow, till it is of a proper consistence, produces about forty pounds of very good soft soap.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, September 25, W. Ball, Esq., on the Comic Literature of the Kingdom (apart from the Drama) Friday, September 27, R. H. Semple, Esq., on the Nature and Properties of Poisons (in conclusion). At half-past eight o'clock precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Sept. 26, T. Claxton, Esq., on Mechanics. At half-past Eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Sept. 24, H. C. Deacon, Esq., on Music. At a quarter to nine.

QUERIES.

Chubb's Patent Night Commode.—Sir, Seeing an account of "Chubb's Patent Night Commodes," in your last No., I should feel obliged by your informing me where they may be obtained?

[At Kent and Co.'s, Falcon-square, near the New Post Office.]

What are the different portions of gases in the atmosphere, and their properties? W—D.

How to take out stains of red ink? Also, where I can obtain sheet zinc in small quantities? T. S. R.

I should feel myself much obliged, if any of your readers who are artists, or concerned in water colours, would tell me, if any volatile oil or spirit should be used in forming the powder of ultramarine, or of carmine, into cakes for water-colour drawing; or if merely gum and water sufficient to form the cake is all that is required?

1. To make rocket *cases*. I have rolled them round a stick, but that plan is too slow, and the cases are not firm enough for the purpose to which I mean to apply them. 2. I should feel obliged to T. Mitchel if he would inform me how to stain paper a scarlet colour, similar to scarlet cloth; and how the beautiful gloss is put upon it?

PUBLICO.

1. The best way to destroy warts? 2. The easiest way of procuring hydrogen?

ALPHA.

ANSWER TO QUERY.

Cheap Leyden Jar.—I beg to inform "T. S J." that a cheap and very good method of making a Leyden jar, is as follows:—Get a common wine bottle, coat it three parts of the way up with tin-foil; put into the bottle sufficient water to reach up to the foil outside; after which, put in about one pound of steel or iron filings. Your jar so far being completed, now for the nob, or ball, which you may cut out of a piece of cork, and cover it with tin foil or any other conducting substance; cement a wire into it of sufficient length to reach to the iron filings, then put the wire through the cork of your bottle, and your jar is complete. It will not cost more than five shillings and sixpence at most.

TYRO CHEMICUS.

Stepney.

TO CORRESPONDENTS.

Electron.—*His letter has not come to hand; whether the mistake has occurred at the Post-Office, or whether it has been mislaid at our office, we know not; but we regret exceedingly that it has so happened, especially as he appears to desire its insertion. If he will be so kind as to forward us another, it shall appear in our next.*

J. Halliday.—*We will make enquiries respecting the subject of his query, and endeavour to supply the information he requires next week. His communication on the subject of penny postage, contains some valuable hints. His objection to stamped envelopes deserves to be seriously considered. It has been our opinion from the first that small stamps, as proposed by Mr. Hill, would be more convenient than stamped envelopes; but we think, with our correspondent, that it might be advisable to* allow *the stamping of sheets of paper, though it is probable that few would prefer that method in ordinary correspondence.*

Lansamlett *next week.*

An Old Subscriber.—*However disposed we may feel to oblige "An Old Subscriber," as well as each of our readers, we cannot sacrifice to individual opinion so important and useful a department of this publication as the queries and answers. The History of the Railway is proceeding as fast as matter of more immediate interest will allow.*

We have to acknowledge the receipt of numerous communications and queries, which shall be disposed of, as far as possible, in our next.

ERRATUM.

There is a slight inaccuracy in the answers to the question proposed at page 213. The first is evidently an error of the press, the denominator should be $3^2\sqrt{b}$. In the answer at page 318, the sign of the second term of the numerator should be $+$. We offer the following solution as somewhat less circuitous. The cube of the sum of any two quantities will be the cubes of those two quantities plus three times their product by their sum. Hence, cubing the original equation, we have

$$2a + 3\sqrt[3]{(a^2 - x)b} = b \qquad \therefore x = a^2 - \frac{\overline{b - 2a}^3}{27b}$$

W. W.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

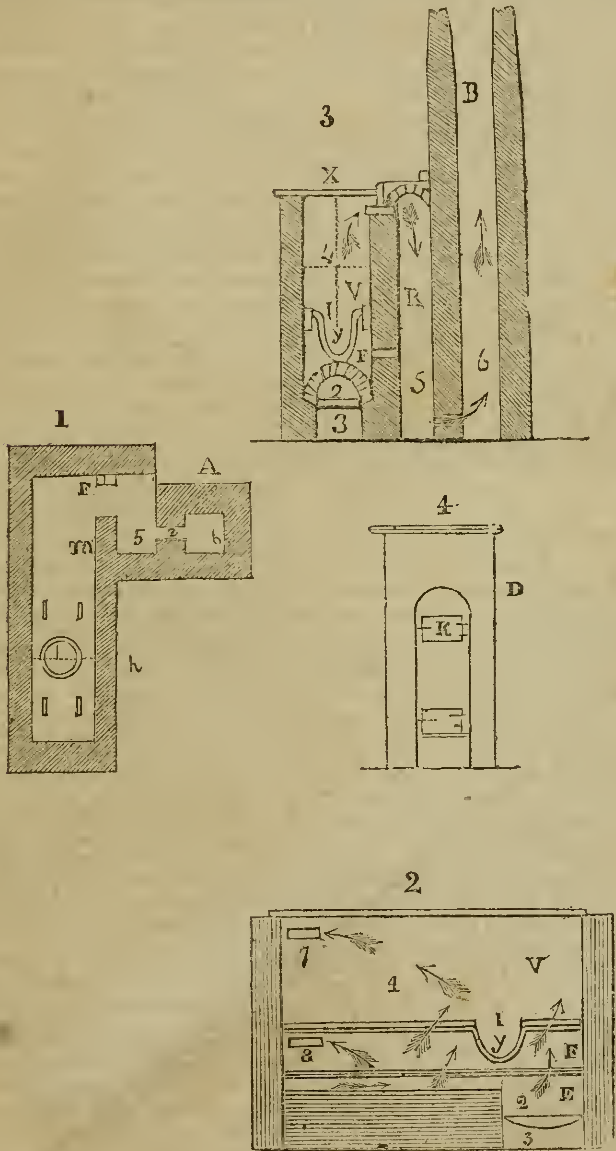
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 50 & 51, NEW SERIES. | SATURDAY, SEPT. 28, 1839. (PRICE TWO PENCE.) | Nos. 171 & 172 OLD SERIES.

DOWLING'S PROCESS FOR PRESERVING METALS FROM OXIDATION



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

DOWLING'S PROCESS FOR PRESERVING METALS FROM OXIDATION.

Compiled from Specification of Patent.

(See engraving, front page.)

The pieces of metal intended to be prepared, are to be first dry rough-ground upon a coarse grinding stone, such as are commonly used for grinding the coarsest hardwares; the grinding will be completed when every part of the surface of the metal has received a rough polish.

The pieces, when so ground, are to be immediately put into a conservative bath, in which they are to remain not less than forty-eight hours, after which time they may be taken out as they are wanted for continuing the process of preparation. This bath is composed as follows: Into a suitable vessel put 120 gallons of soft or rain water, to which add 120 pounds of soda of commerce, thirty pounds of chalk or very good quick-lime, and one gallon of pure olive oil; these ingredients are to be well stirred up together, and in twenty-four hours after, the bath will be fit for use, and the pieces of ground metal may then be put into it, but great care must be had not to let them touch each other, and the liquid ought to be kept as quiet as possible. When the articles are taken out of this bath, they are to be placed in the sunshine, or in any warm place, to dry quickly, but on no account are they to be rubbed for the purpose of drying them.

The next process to which the metals are submitted Mr. Dowling calls "Operating," and it is described as follows:—

The process of operating, is the rubbing of the ground or rough-polished surfaces of the metals, either in a hot or cold state, with zinc, until they have acquired a soft smooth face and zincky appearance, which is perceptible to the touch as well as to the eye. The better to effect this in a superior manner, as well as with economy, certain machines and tools are required; the principle machines used for this purpose are called operating zinc wheels. These wheels may be made of any diameter and breadth, and they may be constructed of any suitable material; they are to be fixed upon the axles in the ordinary manner, and made to revolve in framings sufficiently strong to resist the required speeds. The whole or parts of the circumference of these wheels is or are to be covered with zinc. These wheels require to be perfectly cylindrical, which is easily accomplished by turning them true upon the bearings in which they are to operate. The speed of these wheels varies according to the nature of the work, but Mr. Dowling recommends three wheels employed in succession: the first wheel revolves at the rate of 1200 feet at the circumference, per minute; the second wheel revolves 2900 feet per minute; and the third wheel revolves 4000 feet per minute; but it is not necessary that these exact velocities should be adhered to. The workmen are protected by strong wooden guards, from accident, in case the wheel breaks whilst working at these high speeds. The pieces under operation are held against the wheels, and pressed thereon, more or less, as may be practicable or necessary. The pieces of metal to be operated upon are first submitted to the slowest wheel, and to be finished with the wheel of quickest speed. In preparing pieces of copper or iron which have curvelinear and angular forms, and which cannot be submitted to the circular action of the grinding stones and the operating zinc wheels, the grinding is to be replaced by rasp or very rough filing, and the process of operating is to be done by hand with zinckers, which are tools made of zinc, and which tools are of various forms and sizes to suit the corners and angles of the pieces to be operated upon. The operation of zincking with these zinckers, is simply rubbing, as hard as possible, upon the surface of the metals which have been rasped or rough filed, with the tool or zincker, in the manner of filing until the said surfaces have acquired the appearances before named. In operating upon very large plates of metal, such as boiler plates, plates for large vats or brewing coppers, &c., heavy pieces of zinc called lumps, are employed, and the process of operating with them is by moving them backwards and forwards upon the surface of the plates by an alternate movement. During the process of operating, whether with operating zinc wheels, the zinckers, or the lumps, it will be advantageous from time to time to throw on the surface of the metal under operation a little finely-powdered sal-ammoniac; when the pieces of metal have got a sufficient dose of zinc in the process of operating, they are to be taken to the galvanic-vapour furnace, for the purpose of undergoing the galvanic process, the construction of which, as well as the manner of working it, is thus described:

In the engravings, figs. 1, 2, 3, 4, are shown—first, a sectional plan; second, two vertical sections; third, an end view of the said galvanic furnance. It is composed of a heating furnace, with grate-bars F, vapour galvanic furnace, V, with crucible, J, condensing flue, H. The

figures of reference are as follows:—No. 1 is a crucible made of refractory or fire-clay, in the manner and of similar materials as the crucibles used by glass-blowers.

No. 2 is the heating furnace, with grate bars furnace.

No. 3 is the ash-hole.

No. 4 is the galvanic furnace.

No. 5 is the condensing flue.

No. 6 is the chimney.

No. 7 is a small flue with a damper, which communicates with the galvanic vapour furnace, V, and the condensing furnace, H.

No. 8 is another small flue with a damper, which communicates between the heating furnace and the condensing flue. The flue, No. 8, is to be used only when the fire in the furnace has been nearly lighted; afterwards, when the galvanic vapour-furnace has acquired a heat sufficient to melt lead, then the damper in the flue, No. 8, is to be closed, and the damper in the flue, No. 7, is to be opened.

No. 9 is a flue and damper, communicating with the chimney which is kept open or shut, as circumstances may require, and which can be judged only by the person who has acquired some experience in directing the process. In the furnace, F, an arch is built over the whole length and width of the grate-bars, and the heat is communicated first to the bottom and sides of the crucible, and afterwards passes into the vapour-furnace by the small flue, No. 10; without the interposition of the arch, the crucible would be broken by the direct contact of the flame.

The manner of working this galvanic furnace is as follows:—In the first place, the pieces of metal which have undergone the process of operating, are to be carefully placed in the vapour-furnace, V, and in the condensing flue, H, so as not to touch each other. The pieces are to be introduced through the iron doors, of which a suitable number must be made in the ends and sides of the said flue and furnace. When the furnace and flue are charged with the desired quantity of pieces of metal, the doors are to be carefully closed and luted, to prevent the vapour from coming out during the process. Before closing the vapour-furnace, 100 pounds of zinc must be put into the crucible, J, through the door, R, seen in the front elevation, fig. 4. A fire is now to be lighted in the furnace, F, and the damper, No. 8, is to be opened, and must remain open until the galvanic-vapour furnace has acquired a heat sufficient to melt lead, when the damper is to be closed, and that of No. 7, is to be opened, and kept open till the end of the process, which now in reality commences, and the heat of the furnace must be inward, so as to cause the zinc to burn or deflagrate, and this heat must be kept up during four hours; the fire is then allowed to go out, and the damper of the chimney to be closed, when the process will be finished, the greater or less success of which will depend upon the attention paid to the fires, which ought to be kept up with great regularity, communicating with the chimney during the process, and from time to time it will be of advantage to put a small quantity of green or fresh-cut wood, or bark, into the furnace, F. It will have succeeded satisfactorily if the metal have assumed a dull bluish colour, resembling laminated zinc. The furnace must be kept to cool, after which it is to be opened, and the pieces of metal taken out, and the sublimated zinc, which adheres about the furnace, and more particularly about the walls of the condensing flue, are to be carefully collected. The pieces of metal, as soon as taken out of the furnace, may be covered with a thick coating of good paint or varnish of any required colour.

OPTICAL INSTRUMENTS.

NO. III.

ON SINGLE AND COMPOUND LENSES.

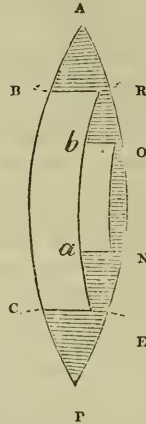
SPECTACLES and reading glasses are among the simplest and most useful of optical instruments. In order to enable a person who has imperfect vision to see small objects distinctly, when they are not far from the eye, such as small manuscript, or a small type, a convex lens of very short focus must be used, both by those who are long and short-sighted. When a short-sighted person, who cannot see well at a distance, wishes to have distinct vision at any particular distance, he must use a concave lens, whose focal length will be found thus:—Multiply the distance at which he sees objects most distinctly, by the distance at which he wishes to see them distinctly with a concave lens, and divide this product by the difference of the above distances. A long-sighted person, who cannot see near objects distinctly, must use a convex lens, whose focal length is found by the preceding rule. In choosing spectacles, however, the best way is to select, out of a number, those which are found to answer best the purposes for which they are particularly intended.

Dr. Wollaston introduced a new kind of spectacles, called *periscopic*, from their

property of giving a wider field of distinct vision than the common ones. The lenses used for this purpose are meniscuses, in which the convexity predominates for long-sighted persons, and concavo-convex lenses, in which the concavity predominates, for short-sighted persons. Convex lenses possess peculiar advantages for concentrating the sun's rays, and for conveying to an immense distance a condensed and parallel beam of light.

M. Buffon found that a convex lens, with a long focal length was preferable to one of a short focal length, for fusing metals by the concentration of the sun's rays. A lens, for example, 32 inches in diameter, and six inches in focal length, with the diameter of its focus eight lines, melted copper in less than a minute; while a small lens, 32 lines in diameter, with a focal length of six lines, and its focus two-thirds of a line, was scarcely capable of heating copper. The most perfect burning lens ever constructed, was executed by Mr. Parker, of Fleet-street, at an expense of 700*l*. It was made of flint-glass, was three feet in diameter, and weighed 212 pounds. It was $3\frac{1}{4}$ inches thick at the centre; the focal distance was six feet eight inches, and the diameter of the sun in its focus one inch. The rays refracted by the lens were received on a second lens, in whose focus the objects to be fused were placed. This second lens had an exposed diameter of 13 inches; its central thickness was $1\frac{5}{8}$ of an inch; the length of its focus was 29 inches. The diameter of the focal image was three-eighths of an inch. Its weight was 21 pounds. The combined focal length of the two lenses was five feet three inches, and the diameter of the focal image half an inch. By means of this powerful lens, platina, gold, silver, copper, tin, flint, quartz, agate, &c., were melted in a few seconds. Various causes have prevented opticians from constructing burning lenses of greater magnitude than that made by Mr. Parker. The impossibility of procuring pure flint glass tolerably free of veins and impurities for a large solid lens; the trouble and expense of casting it into a lenticular form without flaws and impurities; the great increase of central thickness, which becomes necessary by increasing the diameter of the lens; the enormous obstruction that is thus opposed to the transmission of the solar rays, and the increased aberration which dissipates the rays at the focal point, are insuperable obstacles to the construction of solid lenses of any considerable size. In order to improve a solid lens formed of one piece of glass, whose section is A B C P N O A, Buffon proposed to cut out all the glass left white in the figures, viz., the portions between B C, in fig. 1, and *a b*, and between *a b* and the left-hand surface of O N.

Fig. 1.

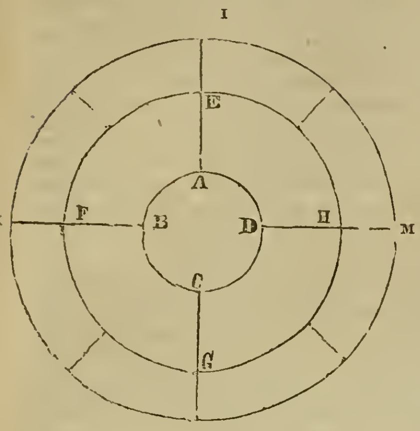


A lens thus constructed, would be incomparably superior to the solid one, A B C P N O A; but such a process would be impracticable on a large scale, from the extreme difficulty of polishing the surfaces A B, C P, R *b*, P *a*, and the left-hand surface of N O; and even if it were practicable, the greatest imperfections in the glass might happen to occur in the parts which are left.

In order to remove these imperfections, and to construct lenses of any size, Dr. Brewster proposed, in 1811, to build them up of separate zones, each of which was again to be composed of separate segments, as shown in fig. 2. This lens is composed of one central lens, A B C D, corresponding with its section, N O, in fig. 1, of a middle ring, E F G H, corresponding to R O N E, in fig. 1, and consisting of five segments, and another ring, I K L M, corresponding to A R E P, and consisting of eight segments. The preceding construction obviously puts it in our power to execute these compound lenses of pure flint glass, free from veins; but it gives another great advantage, namely, that of enabling us to correct very nearly, the spherical aberration, by making the foci of each zone coincide. One of these lenses was constructed under Dr. Brewster's direction, for the Commissioners of Northern Lighthouses, by Messrs. W. and P. Gilbert. It was made of pure flint glass, and three feet in diameter, and consisted of many zones and segments. Lenses of this kind have been made in

France of crown glass, and have been introduced into the principal French lighthouses; a purpose to which they are infi-

Fig. 2.



nitely more adapted than the best constructed parabolic reflectors made of metal. A polyzonal lens of at least four feet in diameter, has been executed as a burning glass.

A. D. M.

INSTITUTION OF CIVIL ENGINEERS.

ABSTRACT OF PROCEEDINGS ON RAILWAYS.

Session, 1839.

"On Tubing the Boilers of Locomotive Engines." By George Buck, M. Inst. C. E.

In this communication, the author has attempted to determine the diameter of the tubes of the boiler of a locomotive engine, so that the effect in the generation of steam may be a maximum. The following are the conditions upon which the problem is solved:—That the evaporating effect of the hot air, in passing through the tubes, is in proportion to the extent of surface in contact with the hot air, and as the time of contact conjointly. The following are the results of the investigation:—The distance between the centres of two adjacent tubes should be equal to four times the interval between their internal surfaces—the diameter of each tube should be equal to three times the same interval—that the tubes should be as near each other as possible.

In illustration, Mr. Buck has drawn two sets of tubes of the locomotive boiler as generally employed, and one as they would be arranged according to the results of this investigation. On comparing the products of the aggregate periphery, and the aggregate area of the tubes, it appears that the boiler, tubed according the above theoretic proportion, is from 23 to 26 per cent. superior to the others.

"Manchester and Leeds Railway Section." By Francis Whishaw, M. Inst. C. E.

This section, prepared under the direction of Mr. Wishaw, is designed to afford a novel and useful method of embodying a great mass of the details required by an engineer when giving evidence before a Parliamentary Committee. This section was constructed before the last Standing Orders, and the author had here anticipated them in putting upon this section much of the detail now required. By sections thus prepared, the engineer can always answer any questions which may be put to him.

"On the comparison between the power of Locomotive Engines and the effect produced by that power at different Velocities." By Professor Barlow, Hon. M. Inst. C.E.

In this communication the author attempts to lay down an appropriate method for computing the power of locomotive engines; and though this method will not serve to exhibit the absolute power of the engines, it may serve to exhibit the comparative power under different conditions. We know the number of cubic feet of water evaporated in any given time; the diameter of the driving wheels, the length of stroke, and the capacity of the cylinder; we hence know how many cubic feet of steam have been employed, and consequently the mean number of cubic feet of steam produced from one cubic foot of water. Again, by experiments that have been made by different writers upon the elastic force of steam, we know the pressure per inch on the piston, and then making due allowance for the resistance of the atmosphere on the piston, the friction of the engine gear, &c., there remains the force that ought to be effective on the piston. This being reduced to the circumference of the wheel, should be equal to the resistance opposed by the load, which on a level plane consists of axle friction, road resistance, and the resistance of the atmosphere to the engine and carriages. But this is assuming that the engine has a perfect action, without any waste, which,

however much to be desired, can never be the case in practice. Thus, comparing what ought to be done in overcoming resistance with what is done, we shall learn the amount of power wastefully expended.

The author then selects some experiments from those made on the North Star and Varvey Coombe engines, as reported by Mr. Wood to the Directors of the Great Western Railway, and illustrates by these the proposed method, and exhibits the results in tables.

From one of these experiments it appears, that the steam power expended per ton of the gross load amounts to 32 lbs., whereas on a tolerably level line it is generally assumed, that the retardation of such a load does not amount to more than 9 lbs. per ton; so that there appears to have been a power expended more than three times as great as the mechanical resistance to which it was opposed, according to views hitherto taken on the subject.

The author then proceeds to consider the resistance to railway trains at different speeds, and these resistances he refers to, 1st. That of the atmosphere; 2nd. The friction of the axles; 3rd. The road resistance. He discusses several experiments made by Mr. Wood, and remarks on the great discrepancies which they present—the atmospheric resistance in one case amounting to 353 lbs. and in another to 99.7 lbs. at the same velocity, viz., 32¼ miles per hour; the friction in the former case being 5 or 6 lbs., and in the latter 20 lbs. per ton. The results of the best experiments on the atmospheric resistance and on friction, show that the former must be considered to vary nearly as the square of the velocity, and the latter to be constant, or independent of the velocity; but this law of the constancy of friction, owing to the peculiar circumstances of the case, cannot hold with respect to the axles of railway trains.

Very much must be attributed to the increase of the road resistance as due to the deflection of the rails at high velocities, and to the state of oscillation to which all the parts of the carriages are subject, and the imperfection of the joints. The author proceeds to make some observations on the actual state of our knowledge with respect to the atmospheric resistance, and the effect of inclined planes on the working of a line of railway. The speed in descending planes is limited by considerations of safety, and in planes of 1-96, 1-100, and 1-220; it is not safe to descend with heavy loads at a greater mean rate than is attainable with the same load on a level; that on planes between 1-750, and a level, the whole attainable speed is admissible.

The method of inferring the power of an engine from the quantity of water evaporated, was objected to on the grounds that so much water is lost by priming.

With respect to the resistance due to the imperfection of the joints, it was remarked that engineers are generally so much restricted as to the expense of making the joints of rails, they cannot adopt that which is the best; and it is a question well worthy of attention, whether the best kind of joint is not the most economical, as the wear and tear would be diminished, and the comfort of the passengers increased, by attention to this point.

The experience of the Dublin and Kingstown Railway showed that great advantages would result from a better kind of joint being used. This railway, though so short, and only having been finished about three years, has had, perhaps, more frequent traversings than a longer railway would in fifteen years; the trains started every half hour, and frequently the departures were increased to every quarter of an hour; the opportunities of observing the effect of the carriages upon the rails were, therefore, excellent.

"Description of an instrument for setting out the width of cuttings and embankments of Railways, Canals, or Roads, as particularly applicable to falling or side-lying ground." By Henry Carr, Grad. Inst. C. E.

The object of this instrument is to facilitate the operation of determining the distance of the outer lockspit from the centre line of a cutting or embankment, by avoiding all calculation, and reducing the usual threefold operation into one. The principle of its construction is the formation of a half cross section, which may be easily altered to suit all cases with regard to base, side slope, and inclination of surface. The construction of the instrument is described in great detail by reference to the drawing accompanying the communication. The author states, that he set out a portion of the South Eastern Railway with this instrument, and found it answer exceedingly well. The experience of the first instrument has suggested some improvement in its construction, which is represented in another drawing.

"Observations on the present mode of executing Railways, with suggestions for a more economical, yet equally efficient sys-

tem, of both executing and working them." By Francis Wishaw, M. Inst. C.E.

The author at the commencement of this paper, alludes to the principal causes of the great differences between the original estimate and cost of railways. Among these he enumerates the imperfect knowledge of the strata, which occasions the cuttings and embankments to be formed with slopes, which are dangerous, and add to their cost—the imperfect formation of the embankments, especially in clayey soils, which, in the opinion of the author, ought to be carried up in layers or courses of from $1\frac{1}{2}$ to 2 yards in thickness, sufficient time being allowed for subsidence before the next layer is added—the cost of stations, which in some of the great lines forms a considerable proportion of the whole cost.

The author then proceeds to suggest means for effecting a considerable saving in the original cost of railways, a certain method of preventing accidents by collision, a saving in the annual expenditure, and a better adaptation of the locomotive engine to its work.

With these views he proposes a single line of rails, that the line should be divided with intermediate engine stations, three on the London and Birmingham, for instance, the engines at each being suited to the prevailing gradient of the district. Thus a line of railway may be more easily laid out, as one or two unfavourable inclines will not affect the working of the whole. At each station there must be a small portion of an additional line of rails, and also at other convenient intervals. The mode of working such a line is as follows:—Engines are to start simultaneously in each direction from the terminal and intermediate stations. These engines will pass each other at one of the portions of the double line, and the engine being reversed and taking the other train, will return to the station from whence it started, when another exchange of trains takes place. Thus there is a regular interchange of loads throughout the day, and each engine is confined to its own portion of the line, and it is impossible that a collision can take place. Equal accommodation would be afforded to the public, and the engine-man, from being always confined to the same small portion of the line, would be perfectly conversant with every part of it. The saving which would on this system be effected, on the original cost, is estimated at more than 5000*l*. per mile.

The attention of the meeting having been called to M. D. Harcourt's artificial granite for railways, blocks, and other purposes, Mr. Rastrick remarked, that he had about a month ago laid down blocks of the Scotch Asphalte, two feet square, on a portion of the Southampton Railway. The sleeper was put in while the block was formed. It was usual to bore holes and to fix the chairs by bolts. He had wished to ascertain how far the blocks would stand the driving in of the bolts, without any boring; they bore this without any apparent injury, and he thought these blocks, weighing about $3\frac{3}{4}$ cwt., would answer the purpose better than blocks of other materials.—*Railway Times*.

THE GALVANIC TELEGRAPH AT THE GREAT WESTERN RAILWAY.

The space occupied by the case containing the machinery (which simply stands upon a table, and can be removed at pleasure to any part of the room) is little more than that required for a gentleman's hat-box. The telegraph is worked by merely pressing small brass keys (similar to those on a keyed bugle) which acting by means of galvanic power, upon various hands placed upon a dial-plate at the other end of the telegraphic line, as far as now opened, point not only to each letter of the alphabet (as each key may be struck or pressed), but the numericals are indicated by the same means, as well as the various points, from a comma to a colon, with notes of admiration and interjection. There is likewise a cross (X) upon the dial, which indicates that when this key is struck, a mistake has been made in some part of the sentence telegraphed, and that an "erasure" is intended. A question—such, for instance, as the following:—"How many passengers started from Drayton by the ten o'clock train?" and the answer could be transmitted from the terminus to Drayton and back in less than two minutes. This was proved on Saturday. This mode of communication is only completed as far as the West Drayton station, which is about $13\frac{1}{2}$ miles from Paddington. There are wires (as may be imagined) communicating with each end, thus far completed, passing through a hollow iron tube, not more than an inch and a half in diameter, which is fixed about six inches above the ground, running parallel with the railway, and about two or three feet distant from it. It is the intention of the Great Western Railway Company to carry the tube along the line as fast as completion of the rails takes place,

and ultimately throughout the whole distance to Bristol. The machinery and the mode of working it are so exceedingly simple, that a child who could read would, after an hour or two's instruction, be enabled efficiently to transmit and receive information.—*Observer.*

WRECK OF THE ROYAL GEORGE.

So much interest has been excited by the recent experiments of Colonel Pasley, that we are induced to give our readers an account, collected from the publ cations of the day, of the loss of the *Royal George*, and some subsequent attempts to recover her. It may be proper to explain that the process of careening is performed by removing the guns, or other heavy bodies, to one side of the ship, so that the opposite side rises out of the water. In the summer of 1782, it was found necessary that the *Royal George*, of 108 guns, commanded by the gallant Admiral Kempenfeldt, and long held as the first ship in the British navy, should receive a sort of slight careen, which the seamen, in their peculiar phraseology, call a *parliament heel:* the ship having to be laid, in a certain degree, upon her side, while the defects under water, which occasion the examination, are rectified. This seems to be a common operation where the defects are not so great as to require a thorough careen; or where the delay, as in the present instance, of going into dock cannot be allowed; and being usually practiced in still weather and smooth water, is supposed to be attended with so little difficulty or danger, that the admiral, captain, officers, and crew, all continued on board, and neither guns, stores, water, or provisions were removed. This business was undertaken betimes in the morning, a gang of carpenters from the Dock attending to assist; and it is said, that finding it necessary to strip off more of her sheathing than was at first expected, their eagerness to come at the leak, induced them to heel her a strake more upon her side than had been intended, and than possibly the commanders knew. The ship, as is usually the case upon coming into port, was crowded with people from the shore; particularly women, who were not estimated at less than 300. Among these were many of the wives and children of the seamen and petty officers, who, knowing the fleet was to sail upon distant perilous service, eagerly embraced the opportunity of coming to see their husbands and fathers. Between eight and nine hundred of the crew of the *Royal George*, including marines, were then on board.

In this situation, about ten in the morning, the admiral being writing in his cabin, and much the greater part of the people being then between decks, a sudden and unexpected squall of wind threw the ship fatally upon her side, and her gun-ports being open, and the motion of the cannon probably increasing the violence of the shock, she almost instantly filled with water, and went to the bottom. A victualler which lay alongside the *Royal George*, was swallowed up in the whirlpool, which the sudden plunge of so vast a body in the water occasioned; and several small craft, though at some moderate distance, were in the most imminent danger.

The admiral, with a number of brave officers, and, in general, most of those who were between decks, perished. The guard, including those who happened to be along with them, on the upper deck, were more fortunate; the greater part being saved by the boats of the fleet. About seventy others were likewise saved. The exact number of people on board at the time could not be ascertained, but it was supposed that from 900 to 1000 were lost. Something about 300, mostly, if not entirely, of the ship's company, were saved. Captain Waghorne, whose gallantry in the North Sea battle, under Admiral Parker, had procured him the command of the ship, had the fortune, though severely battered and bruised, to be saved; but his son, a lieutenant of the *Royal George*, happening to be one of those who were unfortunately below, perished.

Such was the fate of the *Royal George*, which carried the tallest masts, the heaviest metal, and had the greatest number of flags hoisted in her, of any ship in the British navy. She had been repeatedly the seat of command under almost all our great commanders, and upon the greatest occasions during the existing and previous war; and had been peculiarly distinguished under Lord Hawke, in the celebrated battle against M. Conflans, when the French fleet was entirely ruined; and she sunk the *Superbe*, of 70 guns, by a single broadside, and drove the *Soleil Royal*, of 84 guns, on shore, where she was burnt. The loss of the ship, notwithstanding the critical period at which it happened, would not however have been much thought of, if it had not been for the brave men who perished so unfortunately in her. Admiral Kempenfeldt, though near seventy years of age, was peculiarly and universally lamented. He was held, both abroad and

at home, to be, in point of professional science, experience, and judgment, one of the first naval officers in the world; particularly in the art of manœuvring a fleet, in which he was considered by our greatest commanders as unrivalled; and his excellent qualities as a man at least equalled his professional merits as an officer.

A large sum of money, which did honour to the feelings of the public, was immediately raised by subscription in London, for the relief of widows, children, and other depending relations, of those who had perished by this fatal accident. On the following year an elegant monument was erected, in the church-yard of Portsea, with an appropriate inscription, recording the fatal event which so suddenly deprived the nation of a great commander and so many of his brave companions. In 1783 an attempt was made to bring up the wreck; but without success, though the sloop, which was sunk with the *Royal George*, and lay close alongside her, was raised six fathoms from the bottom, and towed a considerable distance.

In 1817 the first survey was made by means of a diving bell. The *Royal George* was found lying nearly east and west, with her head to the westward, and with a trifling inclination on her larboard bilge. The whole of her decks had fallen in, and the starboard broadside upon them; there was, in fact, no appearance whatever of her original formation, her remains appearing as a pile of ruinous timber-work. The surface of her timbers was decayed, but the heart of them was sound. Not the least vestige of her guns, anchors, spars, or masts was discovered, and the whole of her head and rail-work had gone to pieces; the guns were supposed to have fallen into the hull, among the wreck. There was no bank or great accumulation of mud around her; the hollows in her hull contained a quantity of fine black mucose mud, the natural sediment of the tides. It was considered that she might, without much difficulty, have been sawn into pieces, or blown up; but not raised in a body, owing to her ruinous and unconnected state.

We learn with great satisfaction that Colonel Pasley, with the usual success which attends well-directed perseverance, has at length succeeded in firing off one of his enormous sub-marine mines of gunpowder against the wreck of the *Royal George* at Spithead.' At two o'clock on Monday afternoon, as we learn from our Portsmouth correspondent, a cylinder, containing 3,320lb. of powder, was carefully lowered to the bottom, where it was placed alongside the most compact portion of the wreck which has yet been discovered by the divers. This operation was effected by means of hauling lines rove through blocks attached to the bottom of the ships by the divers. When everything was ready, the vessel in which the voltac battery was placed, was drawn off to the distance of 500 feet, which is the length of the connecting wires, and instantaneously on the circuit being completed, the explosion took place, and the effects were very remarkable. At first the surface of the sea, which had before been perfectly smooth and calm, was violently agitated by a sort of tremulous motion, which threw it into small irregular waves, a few inches only in height. This lasted for three or four seconds, when a huge dome of water made its appearance, of a conical or rather bee-hive shape. At first it appeared to rise slowly, but rapidly increased in height and size till it reached the altitude of 28 or 30 feet, in a tolerably compact mass. It then fell down and produced a series of rings, which spread in all directions. The first, or outer one of these, having the aspect of a wave several feet in hight, curled and broke, as if it had been driven towards the shore. Neither the shock nor the sound was so great as had been expected by those who had witnessed the former explosions by Col. Pasley, where the quantity of powder was only 45lb.; but the effect produced on the water at the surface, considering that the depth was ninety feet, was truly astonishing. What the effect has been upon the wreck will not be fully ascertained by the divers till the present spring tides are over, and the long periods of slack water at the neaps enable the divers to remain for upwards of half an hour under water. In the mean time, it is highly satisfactory to know that Colonel Pasley has completely established his command over the application of the voltaic battery to submarine purposes, and that he can now with certainty explode his charges at any depth of water. This will give him the power of placing his cylinders against the most refractory parts of the wreck, and, by blowing these to pieces, and dislocating the knees, timbers, and beams, enable him to draw the whole up, bit by bit, to the surface. Any person who has seen the operation of breaking up a ship on land, knows that this is the only way of going to work with a mass so firmly bound together as a line-of-battle-ship, that even the action of fifty-seven years of decay

under water goes but a small way to disintegrate the parts. The manly perseverance of Colonel Pasley, therefore, we are well convinced, will, in the end, effectually clear the noble anchorage of Spithead of this extremely troublesome obstruction. —*Times.*

INFLUENCE OF COLOUR ON ODOURS.

The attention of Dr. Stark was first directed to the subject of odours, as connected with colour (during his attendance at the anatomical rooms in the winter session), from the following circumstance: Happening one day to attend the rooms in black clothes, he was not a little struck by the almost intolerable smell they had acquired; it was so strong, as to be remarked by the family, and was recognised on the same dress for several days; but no odour to the same extent had been remarked in the lighter-coloured clothes: slight exposure to the air alone was necessary to deprive them of the odour which they had thus contracted. This circumstance induced him to begin a series of experiments, to ascertain, if possible, why different clothes of nearly the same texture, but not of the same colour, should attract odours in proportions so different. The result was, as he conjectured, that the colour of bodies, independent of the nature of the substances, modifies in a striking manner the capability of surfaces for imbibing and giving out odours. He then enclosed six different coloured wools, an equal weight of each, viz., black, blue, green, red, yellow, and white, with assafœtida. They were ranged circularly round the odorous body, without touching it on one another, and were then covered over and excluded from the light. At the end of twenty-four hours they were examined. The black was found to have much the strongest smell of assafœtida; the blue the next; after that the red, and then the green: the yellow had but little smell, and the white scarcely any.

A similar experiment, using camphor instaed of assafœtida, afforded precisely the same results.

Various coloured cottons were treated in the same manner. In all these the smell was invariably found to be of corresponding intensity, according to the colour, as in the wools. Silks of different colours gave the same results.

" It is proper to mention," says Dr. Stark, " that in most of these experiments I did not trust to my own olfactory organs alone. All the members of the family, and several of my friends, have lent their aid to distinguish between the different intensities of the odour which each substance had attracted; and though only a few experiments are here detailed, similar ones have been many times performed, with various other odorous substances. The whole of these in their general results seemed to establish the fact, that the colour of substances exerted a peculiar influence over the absorption of odours—[*Query.* May not the sickly disagreeable effluvium which is known to proceed from the skins of the negroes, to be in some way connected with this theory!]

" In all these experiments, however, reliance had to be placed upon one sense alone, viz., that of smell, as nome of the substances employed had gained any appreciable weight. I was therefore desirous, that, if possible, at least one experiment should be devised, which would show, by the evidence of actual increase of weight, that one colour invariably attracted more of an odorous substance than another; and upon considering the various odorous substances which could be easily volatilized without change, and whose odour was inseparable from the substance, I fixed upon camphor as the one best suited to my purpose. In an experiment of this nature, it was necessary that the camphor should be volatilised, or converted into vapour, and that the coloured substances should be so placed as to come into contact with the camphor while in that state. It was therefore of the first importance to prevent currents of air within the vessel in which the experiment was conducted; and with this view I used a funnel-shaped vessel of tin plate, open at the top and bottom. This rested on a plate of sheet iron. In the centre of which the camphor to be volatilised was placed. The coloured substances, after being accurately weighed, were supported on a bent wire, and introduced through the upper aperture. This was then covered over with a plate of glass. Heat was now applied gently to volatilise the camphor; and when the heat was withdrawn, and the apparatus cool, the coloured substances were again accurately weighed, and the difference in weight noted down.

" Proceeding on this plan, I arrived at the most satisfactory and conclusive results. The deposition of the camphor in various proportions on the coloured substances submitted to experiment, offered evidence of the particular attraction of colours for odours, resting on ocular demonstration; and when to this is added

the evidence arising from a positive increase of weight, as ascertained by the balance, the conclusions previously drawn from the sense of smell are confirmed in a singular and very satisfactory manner." Dr. Stark proceeds to show, as the result of successive experiments, that "animal substances have a greater attraction for odours than vegetable matters, and that all these have their power much increased by their greater darkness or intensity of colour!"—also, "that the whole of the substances lose their sensible odour in nearly the same time, though the odorous particles given out by the black, were of course much greater in quantity than in the others."—*Phil. Trans.*

ALPHA.

PENNY POSTAGE.

To the Editor of the Mechanic and Chemist.

SIR,—As you have politely offered to receive any communications the readers of your useful publication may please to make on the subject of the new postage law, I beg leave to offer a few observations, not as an organization of a complete system, for that I cannot hope to accomplish; but if only a hint should be gathered therefrom by those who have the carrying into effect of this important measure, my object will be fully accomplished.

It appears to me, that the rate of postage throughout the kingdom should be uniformly that of a penny in the manner proposed, but left open to pay in advance or on delivery, for the following reasons: because it is more congenial to the present system and habits of the people; for as an experiment only, it is certainly too great a change to introduce a kind of forced prepayment, however small the amount; experience at the same time feels, that great and sudden changes, political and moral, are not always the best; therefore the change, in order to be durable, should be worked out gradually, for I am persuaded, if stamped envelopes alone are used, many letters will not be written at all, that would be, if left open for payment as now, especially amongst the poorer classes, and those situated in remote country places, where stamps could not be readily purchased; at any rate this would be the case for some time, until the system became general. Another thing, the stamped covers are evidently a partial monopoly, the least semblance of which should not enter into a scheme intended for the public good; next comes the liability of forging them. At first sight it may seem unlikely anyone would attempt forgery for so small an amount, but it must be seen that this system might be carried on in the wholesale style, and instead of a single sheet, quires and reams might be manufactured. It probably may be very difficult to imitate Mr. Dickenson's envelopes, but what one man has accomplished, another may; and what will not unprincipled persons do for the sake of gain? In spite of all protection against forgery and coining, it is yet nevertheless carried on to a frightful extent; and will not this plan open to all such a new field of action, and if once effected, the facility with which these false wrappers might be disposed of would be immense, to the great loss of the revenue, and probably the ruin of the whole business. This I hold as the strongest argument against the adoption of forced payment of stamps; but there is another: it is very evident, that until such a system were well known, and perhaps always, a great quantity of letters will be put into the Post-office, as usual, unstamped; these therefore, could not be forwarded, unless some provision were made for charging for them on delivery. This point seems worthy of consideration, or else it will produce much inconvenience and loss; and hence, it is plain, money transactions in the Post-office cannot be under these circumstances simultaneously abandoned. And after all, as the arrangements of this great and beneficial measure is vested in the hands of the Lords of the Treasury, stamped covers could be introduced; ultimately, should the voluntary system not be found to answer. Rowland Hill's plan, although excellent in principle, and will doubtless immortalize his name, proposes so great a revolution, that attempting to carry it all at once, will, I fear considerably endanger its success.

I remain yours, &c.

A SINCERE FRIEND TO THE MEASURE.

THE CHEMIST.

ACIDS.

NO. II.

BOLETIC ACID was obtained by Braconnet from the *boletus pseudo ignarius*, by evaporating its expressed juice to the thickness of syrup, digesting it in alcohol, dissolving the residue in water, and adding nitrate of lead to the aqueous solution; the precipitate washed and diffused through water, was decomposed by sulphuretted hydrogen; the liquor was then filtered and evaporated till it formed chrystals, which

were purified by solution in alcohol and evaporation. These chrystals are boletic acid; they are prismatic, and require 180 parts of water at 68°, and 45 of alcohol for their solution, which reddens blues and precipitates nitrate of lead, and the salts containing the peroxide, but not those of the protoxide of iron. This acid sublimes with little alteration when heated. It forms salts called *boletates*.

Bromic acid is obtained by the decomposition of a solution of bromate of baryta; by sulphuric acid, sulphate of baryta is precipitated, and a solution of bromic acid obtained, which may be concentrated by slow evaporation; at a high temperature it is partly decomposed, so that it cannot be obtained anhydrous. It is sour, inodorous, and first reddens, then destroys the blue of litmus. It is partially decomposed by sulphuric acid, but not by nitric acid. It is decomposed by sulphurous acid, by sulphuretted hydrogen, and by hydriodic and hydrochloric acids. Its salts are termed *bromates*.

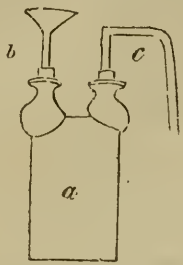
Boracic acid is obtained by dissolving the salt called *borax* in hot water, subsequently adding half its weight of sulphuric acid. As the solution cools, white scaly chrystals appear, which, when washed with cold water, are nearly tasteless, and consist of boracic acid, combined with about 40 per cent. of water, and retaining a little sulphuric acid, which it loses by exposure to a strong red heat, and fuses into a transparent hard glass. The specific gravity before fusion is 1.48; after fusion, about 1.8; at a white heat this acid slowly sublimes. Boracic acid is very difficultly soluble in water; boiling water takes up about one-fiftieth of its weight. The solution reddens vegetable blues, but possesses the singular property of rendering the yellow of turmeric brown, in the manner of an alkali. Boracid acid is partially decomposed by hydrogen at high temperatures, and by some of the metals. Its solution in spirit of wine burns with a green flame. Its salts are called *borates*.

Camphoric acid may be formed by triturating four ounces of camphor with a few drops of spirit of wine. It may be introduced into a two-quart tubulated retort, placed in a sand heat; pour upon it thirty ounces of common nitric acid, and proceed to slow distillation; when two-thirds of the acid has passed over, return it to the retort, and distil as before, repeating the operation twice more, after which, as the liquor cools, a quantity of crystals of camphoric acid are deposited, which are to be washed and dried. This acid assumes the form of plumose crystals, soluble in about 100 parts of water at 60°, and in rather more than one part of alcohol. Its taste is acid, and somewhat acrid, and it has an aromatic odour; exposed to heat, it sublimes unaltered. It combines with the solifiable bases, constituting a class of salts called *camphorates*.

Carbazotic acid may be thus obtained:—A portion of the best indigo is to be broken into small fragments, and moderately heated with eight or ten times its weight of nitric acid. It will dissolve, evolving an abundance of nitrons vapours, and swelling up in the vessel. After the scum has fallen, the liquid is to be boiled, and nitric acid added whilst any disengagement of red vapours is occasioned by it. When the liquid has become cold, a large quantity of semi-transparent yellow crystals will be formed, and if the operation has been well conducted, no artificial tannin or resin will be obtained. The crystals are to be washed with cold water, and then boiled in water sufficient to dissolve them, If any oily drops of tannin form on the surface of the solution, they must be carefully removed, by touching them with filtering paper; then filtering the fluid, and allowing it to cool, yellow brilliant crystalline plates will be obtained, which will not lose their lustre by washing. Sometimes crystals are not formed after the action of the nitric acid on the indigo, in which case the liquor must be evaporated, and water added, when the substance will precipitate, and must be purified as follows:—The precipitate must be dissolved in boiling water, and neutralized by carbonate of potash. Upon cooling, a salt of potash will chrystallize, which should be purified by repeated chrystallizations. The salt obtained in this operation is to be re-dissolved in boiling water, and nitric, muriatic, or sulphuric acid added; as the solution cools, this peculiar substance will be observed to form very brilliant plates, of a clear yellow colour, generally in equilateral triangular forms. When the substance is heated it fuses, and is volatilized without decomposition; when subjected to a sudden strong heat it inflames, without explosion, its vaporous burning with a yellow flame and a carbonaceous residue remaining. It is but little soluble in cold water, but much more in boiling water; the solution has a bright yellow colour; reddus litmus has an extremely bitter taste, and acts like a strong acid on metalic oxides, dissolving them; ether and alcohol dissolve it readily. It forms a class of salts called *Carborsotates*.

Carbonic Acid may be procured by acting upon *carbonate of lime*, by dilute muriatic

acid, for this purpose :—The carbonate of lime is introduced into the two necked bottle, and covered with water ; muriatic acid is then slowly poured down the

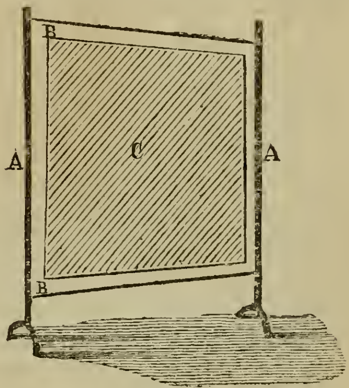


funnel b which causes an immediate effervescence, and the gas passes through the bent tube B, from whence it may be collected by the pneumatic trough. Carbonic acid may be collected over water, but must be preserved in vessels with glass stoppers, since water, at common temperature and pressure, takes up its own volume and acquires a specific gravity—1. 0015, under a pressure of two atmospheres twice its volume, and so on. It thus becomes brisk and tart, and reddens delicate vegetable blues. If litmus paper thus reddened be exposed to the air, the blue colour returns as the acid evaporates. Carbonic acid, though gaseous at all common temperatures and pressures, may be compressed into a liquid state. For this purpose, Mr. Faraday proceeded as follows. A strong tube, of about one fourth of an inch diameter and eight inches long, being bent at about two inches from its end, sulphuric acid was poured in through a small funnel so as not to soil the larger leg, which was then loosely filled with fragments of carbonate of ammonia; it was then hermetically sealed, the acid was then made to run upon the salt, and the enclosed carbonic acid gradually appeared in the liquid form. *Liquid carbonic acid* is limpid, colourless, extremely fluid, and floats upon the other contents of the tube. By enclosing a guage in a tube in which fluid carbonic acid was afterwards produced, it was found that its vapour exerted a pressure of 36 atmospheres at a temperature of 32 deg. Carbonic acid is unrespirable, and when pure immediately suffocates an animal plunged into it. The weight may be shown by placing a lighted taper at the bottom of a tall glass jar, and then pouring the gas out of a bottle into it in the manner of a liquid ; it descends and extinguishes the flame, and will remain for some time in the lower part of the vessel. The miners call it *choak damp.* Carbonic acid retards the putrifaction of the greater number of animal substances applied to the roots of vegetables in a gaseous solution. Its production in the lungs is easily shown by blowing the expired air through lime-water, by means of a small tube ; it becomes milky, and soon deposits carbonate of lime ; with bases it forms a class of salts termed *Carbonates.* T. MITCHELL.

SUBSTITUTE FOR A LEYDEN JAR.

To the Editor of the Mechanic and Chemist.

SIR,—Having paid a visit to the Gallery of Practical Science about a week since, I saw among the multiplicity of things there exhibited, a capital substitute for a Leyden jar, and I have sent you a cheap substitute for the same. B B, is a piece



of stiff card-board, supported by two insulated pillars, *a a*, on each side of which is pasted a square piece of tinfoil, C; when charged, the person to whom the shock is to be given, must put his hands on both pieces of tin-foil, and the effect will be the same as with a Leyden jar.

TYRO CHEMICUS.

DISCOVERY OF FOSSIL REMAINS NEAR WOODBRIDGE, SUFFOLK.

(From the Ipswich Express.)

A DISCOVERY of fossil remains has been made at Kingston, near Woodbridge, which is likely to excite an extraordinary stir in the geological world. The jaw of a monkey, and that of an opossum, completely fossilised, have been obtained from a pit by the side of the Deben, where the clay is dug for the purpose of making bricks. Not only have the remains of these two animals hitherto been unknown to occur as fossils in this country, but the stratum in which they have been discovered, and which is geologically termed the

"London clay," has previously not been supposed to contain any traces of fossil quadrupeds at all. At the meeting of the British Association, Birmingham, Mr. Lyell announced the discovery to the Geological Section, but the details form the subject of two papers in the "Magazine of Natural History" for the present month—one by Mr. Searles Wood, the late curator of the Geological Society, and formerly of Hasketon, Suffolk, who, in conjunuction with Professor Owen, the celebrated comparative anatomist, describes the remains of the monkey, which appears to differ from any existing species of this tribe; and the other, relating to the opossum, is by the Editor of the Magazine, Mr. Edward Charlesworth. We extract from the Magazine Mr. Wood's letter:—

"No, 15, Bernard-street, Aug. 21, 1839.

"Sir,—Hearing from Mr. Lloyd that a mammiferous tooth had been obtained by Mr. Wm. Colchester, from a clay-pit at Kingston, near Woodbridge, I was naturally desirous of visiting the spot, which I did, not without a slight hope of finding more, or at least of inducing a further search to be undertaken. The bed in which the tooth was found, lies immediately beneath a stratum of blue clay, which is used by Mr. Colchester in making bricks; but as the digging and working are only carried on during the winter, I was fearful that little could be done before that period. Hearing, however, from one of the men that a heap of sand, lying near the pit, had been thrown aside from those beds, I prevailed on Mr. Colchester, who was with me, to employ a boy to sift and search it, thinking it would probably yield something for the trouble, having myself, in the course of a few minutes, found several fishes' teeth upon the surface. I am happy to say, that I have since received a letter from Mr. Colchester, accompanied by a fossil; the specimen has been examined by Mr. Owen, who has kindly undertaken to give his opinion respecting it, in a paper to accompany the present communication. As this is the first notice of a quadrumaneous (of the monkey tribe) animal having been found in England, it is of great importance correctly to ascertain the age of the bed to which it belongs; the fossil itself contains sufficient internal evidence to remove all doubt of its genuineness, as it had not the least appearance that a recent tooth would have assumed, conceiving such to have been accidentally introduced into the heap, even if Mr. Owen's determination of its extinct character was not a warrant for its originality. I received with it one or two fragments of bone, not yet satisfactorily identified; numerous fishes' teeth of the genus Lamna; and a specimen of Turbinolia. The teeth possess the sharpness of recent specimens, and were probably quietly deposited in their present locality, but the coral has undergoue so much bouldering as to destroy its character and defy identification. The bed whence these remains were obtained, is a whitish sand beneath a stratum of tenacious blue clay, situated by the side of the river, about a mile from Woodbridge, in a parish commonly called Kyson. This clay may be traced beneath the crag not more than twenty yards from the pit, and is a continuation of the same bed which extends over a large portion of the eastern side of the county of Suffolk. Sections of this clay, with overlaying crag, may be seen at Sutton Bawdsey, Felixstow, &c.; and although in all my searching for fossils, I have never been able to detect a single shell in the clay deposit, the Septariæ, which are dredged up off Harwich, contain shells that have been identified with those of the London clay; and it is fair to assume that, as purt of the bed connecting this clay at Felixstow and Walton-on-the-Naze, there is little doubt of its belonging to the eocene period; but at Kyson, which is one of the western limits of the crag, the beds become more irregular, and the shells are much comminuted, and at Hasketon, scarcely two miles further westward, the clay assumes a different character, being mixed with the detritus of the older rocks. I have there picked up shells of the Echini filled with chalk. The only doubt respecting the bed at Kingston would be, whether it could all belong to that extensive diluvial deposit which approaches so near. As this fossil certainly belongs to some quadrumaneous animal, there is no formation to which it could be so appropriately assigned as that of the London clay—the tropical character of the Fauna, as well as of the Flora of that period, being such as to justify an assumption of a warmer climate, quite suitable to the existence of our Macacu. However, I have given you the particulars of its discovery, and I conslgn the details to abler hands.

I am yours. &c.

S. V. Wood."

MISCELLANEA.

Rival to the Daguerreotype.—If we believe the German papers, Leipmann, of Berlin, has invented a machine for obtaining correct copies of oil-coloured pictures, which is not less ingenious than the Daguerreotype. For some years a little slender-made man, whose attire denoted poverty, was observed in the Museum of Berlin, where he was to be seen every week. Instead of walking through the galleries and examining the various paintings, he was always in the Flemish room, stationed before the same picture—a portrait of Rembrandt. He would remain there for hours together, his hands behind his back, and his eye fixed upon the picture. This was ascribed to eccentricity, whilst it was a serious and singular study, leading to a discovery which will form an era in the history of painting. M. Leipmann was meditating upon the invention of a machine for reproducing oil paintings, and, after ten years of persevering labour, he has succeeded beyond all expectation. At his residence are to be seen above a hundred copies of that head of Rembrant, all of them of scrupulous resemblance to one another. How he has achieved this, is his own secret. When one considers what privations he must have suffered in realizing his ideas, one cannot help wishing that his efforts may be rewarded. With the assistance of a trust-worthy maid-servant, he has laboured for many years night and day, making sealing-wax at night to procure a livelihood, The most surprising circumstance is, that he did not previously make a complete copy of the picture, but con-

veyed it home by parts as he had it in his mind after visiting the Museum. Thus, on one day it was an eye, on another the nose, on a third a lock of hair that he took home, which must have required whole years for the completion of his task. He has produced with his machine, in one of the rooms of the Royal Museum, and in presence of the Directors, 110 copies of Rembrandt's portrait, painted by himself—a picture, the copying of which in the usual way presents the utmost difficulties, according to the opinion of all painters. Leipmann's copies are said to be perfect, and to give the most delicate shades of the colour. He asks but a *louis d'or* for a copy. His invention excites universal admiration.

Electro-Magnetic Navigation.—Mr. Faraday has recently received a letter from H M. Jacobi, dated St. Petersburgh, on the application of electro-magnetism to navigation. The following is a short extract:—"In the application of electro-magnetism to the movement of machines, the most important obstacle always has been the embarrassment and difficult manipulation of the battery. The obstacle exists no longer. During the autumn of 1838, and at a season (in 1839) already too advanced, I made, as you will have learned by the *Gazettes*, the first experiments in navigation on the Neva, with a ten-oared shallop, furnished with paddle-wheels, which were put in motion by an electro-magnetic machine. Although we voyaged during entire days, and usually with ten or twelve persons on board, I was not satisfied with this first trial, for there were so many faults of construction, and want of insulation in the machines and battery, which could not be repaired on the spot, that I was terribly annoyed. All those repairs and important changes being accomplished, the experiments will shortly be recommenced. The experience of the past year, combined with the recent improvements of the battery, give as the result, that to produce the force of one-horse (steam-engine estimation), it will require a battery of twenty square feet of platina distributed in a convenient manner, but I hope that eight to ten square feet will produce the effect. If Heaven preserve my health, which is a little affected by continual labour, I hope that by next midsummer I shall have equipped an electro-magnetic vessel of from 40 to 50-horse power!"

Alpaca Wool.—At the late meeting of the British Association at Liverpool, samples were shown of a manufactured specimen of Alpaca Wool, resembling silk, being black as jet without dye, and more valuable in many of its qualities than sheep's wool. The animals producing it are of the Llama tribe, and, it is said, might with advantage be propagated by the agriculturists of the United Kingdom. The Alpaca is well suited to this country, but more particularly to Scotland and Wales, being an inhabitant of the Corderleræ, a mountainous district in Peru, below the line of perpetual snow, about 160 miles in extent. They are nowhere else to be found in South America, either on the east or western coasts. Importations of the wool have already taken place to the extent of 1,000,000 lbs., which are likely to increase; and some of the animals are already in New South Wales. The Alpaca has fine wool, six to twelve inches long, as shown by the specimens exhibited. It is used as deer in the parks of the old Spanish grandees in Peru, and its flesh is eatable and equal to any venison. It has been propagated by the Earl of Derby in his menagerie at Knowsley, and there are a few specimens in the London and Liverpool Zoological Gardens. Their breeding here would not interfere with wool, but come more in competition with silk. The Alpaca should not be penned up in English parks or gardens, but left to range in the mountains, where it will find food congenial to its nature, not being susceptible of cold. It does not perspire as sheep do; the wool exhibits no animal grease, and is shipped just as when clipped. The animal, therefore, does not require the care and attention which sheep do in the Highlands of Scotland, to be loaded with tar and butter, to preserve them from death. The Alpaca wool is capable of the finest manufacture, and is especially suited to the fine shawl trade of Paisley, Glasgow, Edinburgh, &c. The yarns spun from it are already sent to France in great quantities, at from 6s. to 12s. 6d. per lb. The price of the raw Alpaca wool is now 2s. to 2s. 6d. per lb., and it is not likely to go below 1s. 6d. Mr. Dawson, Woolbroker, Liverpool, offers to furnish gratuitously, one or two pounds of the wool to any agriculturist, or any silk or woollen manufacturer, who feels interested in the matter, on application to him at Liverpool.

Doctor Turnbull's Successful Method of Treating Deafness.—In an age of empiricism like the present, we are inclined rather to commend than censure the caution of the public in receiving with diffidence the reported success of any man in the treatment of maladies, over which surgical skill has hitherto had but slight effect. It is now some time since we first heard of the extraordinary cures performed by Dr. Turnbull, of Russell-square; but though we heard and read well of his character as a physician, we deferred judgment until satisfied by the evidence of our own senses. We have within the past week witnessed this proof in the person of one born deaf and dumb, and to whom he has restored the faculty of hearing, and of articulation also. This, we are assured, is achieved by no surgical operation, nor is there any affectation of mystery about the treatment, which consists in the simple application of a certain fluid, no occult process—the only talisman is the Ephphatha, the "be ye opened" of skill and science, to whose triumphs Dr. Turnbull has eminently contributed. We think it right, more for the sake of society than this gentleman, who, however, may be deemed one of its best benefactors, to publish a fact, the announcement of which must give infinite pleasure to the friends of all those who may labour under the most distressing of all defects.—*Bristol Times.*

Shock of an Earthquake.—On Sunday morning last, between the hours of two and three o'clock, a severe shock of an earthquake was felt at Newport. The same shock was felt at Lantarnam, Caerleon, and neighbourhood. It was so severe at one time, that several of the bedroom bells at Lantarnam House were set ringing.—*Monmouthshire Beacon.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 2, W. Ball, Esq., on the Comic Literature of the Kingdom (apart from the Drama). Friday, Oct. 4, T. Walker, Esq., B. A., on Astronomy. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 3, T. Claxton, Esq., on the Steam Engine. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Tuesday, Oct. 1, Quarterly Meeting.

QUERIES.

1. In the making of water colours, how are they formed into square cakes, and stamped? 2. How to make Frankfort black? 3. How to make infusion of gentian as it is sold in the chemists' shops? F. F. F.

Where can I obtain at the cheapest rate a small boiler for a model of a steam engine (say four or five inches in diameter); also small tubing and stop-cocks for the same? Could not I construct one with a ball-cock, such as those commonly used for cisterns?

A CONSTANT READER.

How to make a cement to join wood to glass?

A SUBSCRIBER.

[Shell-lac dissolved in spirits of wine, with the addition of a small quantity of isinglass dissolved in diluted spirit; or if the nature of the materials will allow it, shell-lac alone, which is more convenient, and dry as soon as it is cold. The two surfaces must be heated to the temperature of melted shell-lac, otherwise it will not adhere.—ED.]

ANSWERS TO QUERIES.

To Remove Warts.—"Alpha." I have seen warts removed by applying the juice of apples to them. I have a brother, about ten years old, who had his fingers almost covered with them. He was advised about two months ago to cut an apple through the middle, and apply the juice to them, when in the course of a fortnight they were completely removed, and his fingers are now as smooth as silk. A. W. G.

French Polish.—Take three quarters of an ounce of seed lac, three drams gum juniper, two drams gum mastic, and four ounces spirit of wine, avoirdupoise; powder the ingredients, and mix them with the spirit in a glass bottle that will contain double the quantity. Set the mixture in a warm place, and shake it twice or thrice a day, taking care to loosen the cork during the shaking. Four or five days will be sufficient for dissolving the resin, when it will be fit for use.

The Gases contained in the Atmosphere are 20 parts of oxygen, and 80 of nitrogen, upon which one of carbonic acid and a little hydrogen often encroach; but pure atmospheric air is composed of four volumes of nitrogen and one of oxygen, exactly; that is, five pints of air contain one pint of oxygen, and four pints of nitrogen. Of the latter there are five compounds:—First, 1 oxygen, 4 nitrogen; second, 1 oxygen, 2 nitrogen; third, 1 oxygen, 1 nitrogen; fourth, 3 oxygen, 2 nitrogen; fifth, 5 oxygen, 2 nitrogen. The first union forms air; the second, nitrous oxide, or laughing gas; the third, nitric oxide; the fourth, nitrous acid; the fifth, nitric acid. The first two are respirable; the others are destructive of human life, though phosphorous burns rapidly in the third. Nitrogen combines only with one solid, viz. carbon, in the proportion of 2 carbon, 1 nitrogen, which forms cyanogen; 1 of this, and 1 of hydrogen, form the deadly hydrocyanic, or prussic acid. Oxygen is the great supporter of life and combustion, and combines with all the simple solids.

Barometer Tube.—This may be cleaned with a mixture of hot water, sand, and subcarbonate of potash (salt of tartar).

"Alpha" will find two pennyworth of nitrate of silver answer his purpose well—*probatum est.*

"Publico" may make his cases firm as wood, by pasting his paper all the way down, and rolling it round, about forty times.

To procure Hydrogen.—Hydrogen is most readily made by melting a piece of zinc in a tobacco pipe, and pouring it from a height into water to reduce it to small pieces. Collect these, and put them into a wine bottle, with a quantity of sulphuric acid, and six times as much water.

"T. S. R." may obtain sheet zinc at any plumber's for about fivepence a pound.

To Dissolve India Rubber.—"F. P. H. T." will never, we fear, be able to dissolve India-rubber in spirit of naptha alone. As for coal naptha, we believe chemists sell little else. We can recommend a mixture of spirit of naptha and spirit of turpentine, as we have tried it, and succeeded.

W. W.

TO CORRESPONDENTS.

W. G. C. *will perceive that the present number commences the Fifth Volume of the* MECHANIC *and the second of the New Series; the great number of Supplements, or double numbers, which we have lately published, is the cause of our deviating from the intention we formerly expressed of terminating the volume at the end of the year.*

We have received several books, the notice of which is unavoidably deferred till next week.

Owing to the late hour at which we received the interesting account of Col. Pasley's last and successful experiment on the wreck of the Royal George, we are compelled to defer, till next week, the answers to numerous correspondents, which should have appeared in the present number.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

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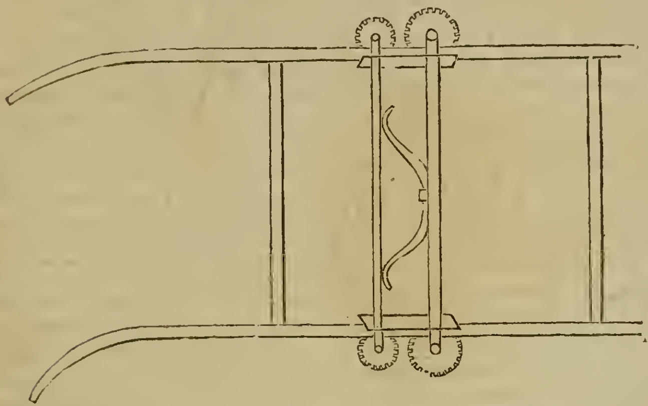
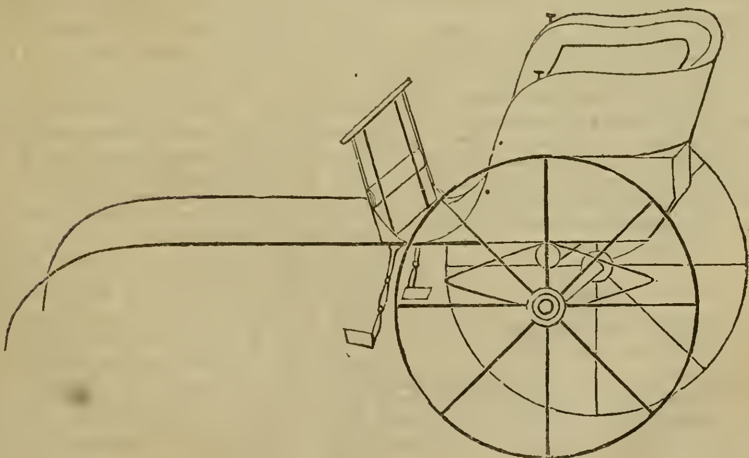
A MAGAZINE OF THE ARTS AND SCIENCES.

No. 52 NEW SERIES. | SATURDAY, OCT. 5, 1839. PRICE ONE PENNY. | No. 173 OLD SERIES.

APPARATUS TO PREVENT HORSES RUNNING AWAY.





 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

APPARATUS FOR PREVENTING HORSES FROM RUNNING AWAY.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—In page 130 of the second volume of your magazine, there is a description of a proposed plan to prevent horses running away. There is also another plan in page 209, both of which may in some measure answer the purpose; but yet they are very defective. I have lately invented a plan far superior to either of the above. With my apparatus, I can in one moment not only stop the horses from proceeding, but can prevent their backing or turning to the right, or to the left, and the next moment release them, and again allow them to proceed; and if they still prove restive, secure them as before. This can be done without the driver moving from his seat, or putting either whip or reins from his hands. It is so easily managed, that a lady, or even a child, has a perfect command over it. It can be attached to any kind of vehicle now in use with little expense, nor is it at all unsightly. It is always ready for use, as there is no spring to wind up, or latch to set, as in the first of the two above mentioned; nor can it strain the carriage or gig in any way, as the second is likely to do. It will be found particularly convenient to commercial travellers and others who have at times to leave their gigs at the doors of those persons upon whom they call, as a horse cannot possibly move from the place where left by the driver, when confined by this apparatus.

The reason why I have not sent a more exact description of my invention is, that my circumstances will not allow me (after all the time, trouble, &c., which it has cost me) to make my invention publicly known without remuneration; but if any person with capital is inclined to assist me in procuring a patent, or otherwise securing the benefits arising from the invention, I am disposed to treat with him.

I remain yours, &c.

A. B.

DEPARTURE OF THE NEW ZEALAND COLONY.

The Directors of this Company, together with a vast number of persons interested in the colonization of New Zealand, made an excursion to Gravesend on Saturday se'nnight, for the purpose of inspecting the ships which, under the auspices of the Company, have been freighted with emigrants to that distant region, and for the purpose also of transacting other important and interesting business connected with the foundation of the new colony. The *Mercury* steam-boat was employed for the occasion; and though one of the largest vessels engaged between London and Gravesend, her decks and cabins were completely thronged by the multitude of persons who had been invited, every one of whom had a deep interest in the object of the expedition. The *Mercury* herself was gaily dressed in the colours of all nations, the red cross of England floating supreme above the rest. An ample awning covered the after-deck; an excellent band of music was stationed in the waist. She left her moorings at Fresh Wharf about one o'clock, and, contending the whole way against adverse tide and wind, reached Gravesend at half-past three. The three ships it was intended to visit—the *Adelaide*, the *Aurora*, and the *Oriental*—were moored immediately below the town. As the steamer approached, conspicuous by her colours, the emigrants on board these ships crowded upon deck, and received the Directors with loud and hearty cheers. The object of the Directors upon this occasion was twofold,—first, to see that their instructions for the comfort of the emigrants upon the voyage had been rigidly carried into effect; and, secondly, as the sanction of the Government has been withheld from the undertaking—as the infant colony has been left without the aid or protection of the Colonial Office—as no steps have been taken to secure the administration of English laws upon a soil which Englishmen are to inhabit—as all the hopes which, up to the eleventh hour the Company had entertained of even a slight recognition from the Colonial Secretary had been disappointed—under these circumstances, the second object of the Directors was to obtain, if not from each of the emigrants, at least from the great body of them, a voluntary agreement to a charter or code of laws laying down regulations for the maintenance of order, and establishing a machinery for the administration of law and the enforcement of justice. The first ship that the steamer ran alongside was the *Adelaide*. She is a fine vessel, and has been admirably fitted up for the purpose for which she is employed. The arrangements for the comfort and convenience of the passengers of the lower as well as the higher class, appear to be complete. The berths betwixt decks are commodious, and well ventilated; the stores are of the best description—the dietary is ample: in

short, no pains nor expense appear to have been spared to secure the health and comfort of the emigrants upon their long voyage. As soon as the Directors, accompanied by the cabin passengers, and a host of visiters, had reached the poop, the labouring emigrants, with their wives and children, were summoned into the waist; when they were addressed by Mr. G. F. Young, the principal Director present, to the following effect:—"My friends, as one of the Directors of the New Zealand Land Company, I am anxious to address a few words to you upon a subject of great importance to you all. You will, I hope, be aware, from all you have seen as to the arrangements made for your passage to New Zealand, that the Directors of the Company have not lost sight of that which it is equally their duty and their pleasure to perform—have not failed to do every thing in their power to promote your comfort and welfare. But their views for your good are not bounded by providing for your departure from this country—they cast their eyes beyond the present, and contemplate what your position may be in that far distant land, where as yet no such provisions have been made as in every well-organised society are absolutely indispensable for the maintenance of order and the protection of property. The time cannot be far distant when the Government will do that which it is bound to do; but in the mean time it is necessary that some measures should be taken by which you may be protected from those aggressions upon social order which might arise if you were left wholly without laws and the means of obtaining justice. I am therefore about to propose to you to enter into a voluntary agreement, by which the ends I have indicated may be secured to you. I propose to you to sign the document which I now hold in my hand, and which, under the peculiar circumstances in which you are placed, I am sure you will find absolutely indispensable to your security and happiness." The honourable gentleman then read the document at length. It was in substance as follows:—that all the persons and parties to the agreement should submit to be mustered and drilled in such fashion, and at such times as should be deemed necessary to the security of all; that if any person committed an offence against the laws of England, he should be liable to be punished in the same manner as if the offence had been committed in England; that a Committee, to conduct the government of the colony be appointed, with power to make rules and to appoint officers; that an umpire be appointed to preside in all criminal proceedings, and, assisted by seven assessors, to decide on the guilt or innocence of the party accused; that where the assessors (whose office would be similar to that of jurymen in this country) pronounced a party guilty, the umpire (whose office would be similar to that of a magistrate or judge) should state the amount of punishment to be inflicted; that in all civil proceedings the umpire should proceed alone; that the General Committee should have power to appoint five of its members to constitute a Committee of Appeal, whose decisions, in all cases, should be regarded as final; that the Committee should have power to call out the armed inhabitants whenever the occasion required; and, finally, that it should have power to levy such rates and duties as may be necessary for the government of the colony. "Thus, no person can be left in any case, civil or criminal, without the means of prompt redress. It is to be observed, however, that these rules are only intended to remain in force up to the time when British law shall be established under the authority of the British Government, in that magnificent colony which you are to have the pride and happiness of being the first to found."

This address, which was very attentively listened to, was received with a hearty cheer. Every man seemed to concur in the propriety of the proposed code of laws; and when it was placed upon the capstan for signature, there was not one who hesitated to put his name to it.

This part of the business being concluded, the steamer next ran down to the *Oriental*, who received her with a salute fired from half a dozen large guns upon deck. We observed that each of the ships was armed in a similar manner; there was also in each of them an abundance of small arms. The emigrants on board the *Oriental* are of a very superior class. They are chiefly young men and women of from twenty to thirty years of age—the women looking healthy and buxom, the men intelligent and resolute. Here, too, are a number of Highlanders from the estates of the Duke of Sutherland; they are a fine, hardy set of fellows, and capable, no doubt, of fighting their way in any region of the world in which they may be placed. Great care appears to have been taken to secure their comfort. They are clad in one uniform dress—a blue jacket and cap, and tartan trousers—everything upon their backs happens to be perfectly new. The noble duke's agent who has accompanied them from Scotland, remains with them

until the expedition takes its final departure. Mr. G. F. Young, in going through the same ceremony on board the *Oriental*, that had previously been gone through on board the *Ad laide*, addressed himself particularly to this body of men. "I perceive," said he, "that there are many here from Scotland. Scotchmen are generally well educated and well informed in the history of their country. Those whom I am addressing will doubtless remember the solemn league and covenant which, in a former age, was entered into by their countrymen. I now propose to you, the descendants of that firm and inflexible race of men, to enter into another solemn league and covenant for the maintenance of social order in the new society of which you are to be the founders." (Cheers.) The code of laws was received on board the *Oriental*, and afterwards on board the *Aurora*, with the same expressions of approbation as on board the *Adelaide*. It was signed by every man present. Each of the three ships having been visited in turn, the steamer ran back to Gravesend, and preparations were made for dinner. Tables were set out beneath the awning on the after-deck, and in a few minutes were covered with a choice and abundant cold collation. The host of visiters took their seats, and turned to at the solids with right good will; but the enjoyment of this long-anticipated part of the day's proceedings was sadly broken in by the torrents of rain which fell without intermission, against which the awning afforded but a very imperfect protection. The ladies hurried below, where in a short time they were followed by the gentlemen. Here a handsome dessert was quickly produced, and with a copious supply of many kinds of wine upon the table, every one began to make himself comfortable. Now, however, the vessel was again put in motion for the purpose of once more visiting each of the three ships, and of taking a final farewell of the emigrants. Some touching scenes occurred in the separation of friends who had lingered to the last moment; but, generally speaking, the whole body of adventurers, rich and poor, male and female, appeared to be in the highest spirits. It may be here proper to mention, that independent of the three ships of which we have been speaking, there are two others which form part of the same expedition, namely, the *Duke of Roxburgh*, which will take in her passengers at Plymouth, and the *Bengal Merchant*, which will sail from Glasgow. The number of emigrants on board each of the ships is as follows: – *Oriental*, 138; *Adelaide*, 149; *Aurora*, 142; *Duke of Roxburgh*, 120; *Bengal Merchant*, 155; making a total of 704, exclusive of cabin-passengers, whose number on board the five ships amounts to 152.

When the farewells of friends and relatives had been finally exchanged, the *Mercury* took a homeward course; and Mr. G. F. Young immediately assumed the chair in the state room, where upwards of a hundred guests still remained. Now the bottle began to circulate, and a second course of business commenced. There were toasts to be proposed and speeches to be made. The chairman, in the first place, acquainted the company that he had received a communication from Lord Petre, apologizing for his absence, but stating that, as he had a son embarked in the enterprise, his feelings would not permit him to take part in the proceedings upon the eve of his departure. Lord Durham, the Governor of the Company, was also unavoidably absent, having left town for the country. These preliminary matters disposed of, the chairman came to the list of toasts. The first was "The Queen," which was loudly responded to. Then came "The Army and Navy," which was received with applause. The great toast of the day followed—"The Colonists now embarked and embarking for New Zealand." In proposing this toast, the chairman entered into a lengthened but forcible exposition of the difficulties against which the Company had had to contend, in consequence of the refusal of the Government to lend any aid or protection, or even to afford the slightest countenance to the undertaking. He explained also the steps which the Company had taken to preserve the rights and improve the condition of the aborigines; observing that in this respect the present scheme of colonization differed from all others that had ever been carried into effect.

Dr. Evans, the chief colonist, returned thanks in a very able speech; in the course of which he commented in still stronger terms than the Chairman had done, upon the conduct of Government in refusing to lend its sanction to an undertaking of so much importance. Then, speaking of the aborigines, he said, "There are no men on the face of the earth who have a more sincere or heartfelt desire to preserve the rights of the aborigines than we have who are about to depart to those distant shores. We feel that they are our adopted countrymen—*(Cheers)*—and that a wrong or an injury inflicted upon them would be an injury upon ourselves: we will be parties to no transaction in which their rights are

not consulted equally with our own." *(Cheers.)* He concluded by proposing "The health of the Governor and Deputy Governor and Directors of the New Zealand Company.

The Chairman returned thanks.

The Honourable Frederick Tollemache proposed "The health of the members of the Committee that day appointed for the Provisional Administration of the affairs of the Colony."

Mr. Dudley Sinclair returned thanks.

The Chairman then, in a speech of much tact and ability, proposed "The health of Lord John Russell, and Reform in the Colonial Office." He had always regarded, and still continued to regard, the Colonial Office as the worst-managed (owing to the defects of the system itself) of any of the departments of the public service; but he owned he anticipated much from Lord John Russell's frank and manly character—from his readiness to correct abuses, and from his sense of justice.

The toast was drunk with applause.

Several toasts followed. In fact, the list had not been exhausted when the vessel reached her destination at London Bridge.

There were present during the excursion the Honourable Frederick Tollemache, Right Honourable Sir Alexander Johnson, Honourable William Petre, Honourable Henry Petre, Mr. Aglionby, M.P., Mr. Vincent Eyre, Mr. Commissioner Evans, the Rev. Mr. Hawtrey, of Eton, the Rev. Mr. Saxton, Mr. Browne, late M.P. for Sligo, Mr. Few, Mr. Somes, the Deputy-Governor of the Company, Mr. G. F. Young, Mr. Edward Gibbon Wakefield, Mr. Alderman Pirie, Mr. T. A. Hankey, Captain Nairne, Mr. Arthur, Willis, and Mr. Boulcott.

[The foregoing has appeared in several of the London papers, and may be considered as a fair report of the proceedings. The climate of New Zealand is temperate and pleasant; the soil is fertile, and its productions numerous and valuable; its geographical position, with respect to the vast territory of Australia, promises, at some future period, great commercial advantage and importance; it is the interest, as well as the duty, of every true Briton, to promote the extension and security of "the great empire on which the sun never sets." Every friend to his countrymen, and every friend to humanity, will join us in cordially and ardently wishing success to this bold and perilous enterprise; *but* we cannot witness the departure of the expedition, and refrain from expressing that the deep interest we feel in the welfare of the colonists, is accompanied with much anxiety for their safety. They are going to the world's end; for New Zealand is situated at the antipodes, that is to say, it is the remotest country in the world; they are to be abandoned to their own resources, in a wilderness swarming with herds of howling savages, whom Dr. Evans very politely designates "our adopted countrymen." At the very moment of departure, Mr. Young, one of the Directors of the Company, announces, in a sort of parenthesis, that the government of this country has refused to grant them any sanction or protection, either civil or military; but, he adds, the views of the Company for their good, are not bounded by providing for their departure from this country, but, in the absence of positive assistance, they very generously proffer their *advice*, which is, that they should agree among themselves to be their own lawyers, their own judges, their own soldiers, and their own tax-gatherers. It is no doubt very good fun for gentlemen in the state room of the *Mercury*, during their passage to London Bridge, to find "an excuse for the glass," by huzzaing to the health of Ministers who, in their solicitude for places which "touch them more near" than the distant and precarious colony of New Zealand, abandon the adventurous emigrants to their fate. But we cannot divest ourselves of the apprehension that the adventure is one of great hazard and danger.

ED. M. & C.]

THE EGLINTOUN TOURNAMENT.

THE "tournament has proved such a comical, as well as unlucky piece of business—has been so roared at, and so rained on—so pitifully handled by gods and men—that we can hardly find it in our hearts to subjoin anything provoking about it. The account given of the cavalcade going to the lists on Wednesday, the first day of the proceedings, will long remain one of the most heart-rending narratives in the English language. They went *by water*.

"Shower succeeded shower," says a respectable and soaked witness, "each heavier and of longer continuance than its predecessor; and the boundless expanse of heads at length permanently disappeared under a co-extensive canopy of umbrellas."

"At three o'clock," we learn from the same dripping authority, "a perfect deluge of rain was descending;" and the procession about this time "was seen advancing *to the astonishment of everybody.*"

It is highly interesting, by the way, to remark the difference between the English and the Scotch reporters in the tone of

their remarks on this affair of the wet. While the former, born to drier circumstances, fret and chafe themselves into all manner of horrid frames of mind, taking every minute savager views of things in consequence, the latter—wet from childhood—are able to maintain their habitual equanimity, suffering no adhering nankeens to distort the judgment, no saturated under-linens to betray them into hasty remarks. Thus the reporter for the London *Chronicle*, who has no doubt caught his death of cold, instead of taking James's powders, puts himself into almost as good a perspiration by the vehemence with which he falls out with the whole of the expedition; and the *Post's* correspondent, who seems rather of the sarcastic order of writers, takes the same revenge in another shape, when he drowningly remarks—"It does not always rain in Ayrshire, they say, for sometimes it snows. Murphy could hardly fail to make out an accurate programme of the weather for this part of the country, and would only be puzzled in fixing the seven fine days which it is reckoned occur in the course of the year."

Many hard words and cutting reflections have been applied to the knights and their performances; more, we think, than were fairly proportioned to their deserts, considering the severity of the punishment already sustained. The business generally, according to one witness, was "a magnificent abortion:" another gathers the "popular opinion," which he states to have been, "that a greater piece of humbug was never yet practised in the open air." Much exception has been taken to the "lances;" which are a sort of mopsticks, such as servant-girls twirl of a morning before the house-doors, but differing from that weapon in respect of being made weaker and in such a manner as to snap in the middle, and being moreover "rounded off at the end." They were, says one account, "cut across the grain;" and another describes them as "cunningly enfeebled." All accounts appear to agree in making them out a sort of *emasculated mopsticks*.

To see some dozen people break emasculated mopsticks, there came wonderers from America, doubters from Germany, speculators from France—not uninvited. In what humour the nations have got home again, we can scarce trust ourselves to inquire. If they stir up no wars against us for this, we may be thankful. Only conceive! people coming three thousand miles across the seas to see they know not what—but something, they are assured, the most epical, most heroical, most fearful, yet beautiful ever seen, or ever to be seen in this life! There may be occasions in which money ceases to be an object—in which even the most regular man of business, even a Yankee merchant, may be justified in discarding the usual rules of prudence and economy, to seize on delights that can never again recur. This was such an occasion—an occasion "to draw three souls out of one weaver," and even more than three (say three hundred) rix-dollars out of the pocket of one cotton-broker. They come! From all parts, "the cry is still they come!" Wednesday, too, comes; Wednesday—day of days, ever to be memorable in their after lives as that on which all their previous notions of the sublime and beautiful, of the terrors of mortal combat and the limits of human bravery, were exceeded, and a new and nobler standard established in their stead—a day due to poetry, admiration, and enjoyment. Heigho, for the sequel! "Eloquar, an taceam?" With Wednesday, comes Wednesday's sky, that declares against chivalry. "The windows of heaven are opened." Down come the indiscriminate divine slops—up goes the "King of the Tournament's" brown silk umbrella—into a coach scuffles "the Queen of Love and Beauty." Chop-fallen is chivalry. Plumes refuse to "dance," banners won't "wave," flags are flagging; there is no glittering of helmets, no "glancing in the sun," no persuading barbs to "swallow the earth" to-day; no dying gladiators "biting the dust"—no dust to bite! Alas, alas! Harpers are mute, jesters are sad, "fools" look wise, and knights look foolish. Mr. M'Ian "of the London stage" sports in vain his cap and bells; he has no humour, in him, but much humidity. The middle ages *won't* return—that is decreed. What *should* they return for? To see themselves burlesqued? To see this sort of historical "high life below stairs?" To see the desecration of their old iron? To see the collision of emasculated mopsticks?—*Spectator.*

THE CHEMIST.

HENZE'S IMPROVED METHOD OF MANUFACTURING DEXTRINE.

This invention, for which a patent has been granted, consists in the production of dextrine, by means of the admixture of nitric acid with the farina of potatoes, or the flour or starch of wheat, barley, or other appropriate farinaceous grain or

seeds. By this process, the substance is obtained at much less expense than by the method hitherto employed.

The farina, or starch, being in a dry state, a portion of nitric acid, of the specific gravity of about 1.4, equal in weight to one-four-hundredth of the farina, is mixed with such a quantity of water as is sufficient to wet the farina, which is then carefully mixed with the fluid, so that every part may be wetted, as bread is mixed or kneaded. It is not, however, necessary (though Mr. Henzé considers it preferable) that the flour or farina of potatoes and similar substances, should be brought into a dry state, but it may be used as it is obtained from the tub or vat. In such a case, a less portion of water will be required in the admixture of the nitric acid.

The paste thus formed, is divided into lumps of any convenient size, say about twenty-five pounds weight, and these should be put to drain for a few hours, to allow any superfluous moisture to run off. The lumps should then be broken with the hands into small pieces, and placed in a chamber heated to any degree not exceeding 176° Fahrenheit, and kept there till perfectly dry, which at the heat of 176°, will be done within twenty hours, and they are then reduced to the state of flour, by pounding and grinding, and the use of a bolter or seive; and this flour is then placed in an oven, heated to from 212 to 248°, where it is kept till thoroughly dry. The time necessary for this purpose will vary according to the degree of heat, from about a quarter of an hour to five minutes; the lower the degree of heat within the prescribed limits, the whiter will be the dextrine, which is advantageous.

When required for use, the dextrine thus obtained is to be mixed with water, either hot or cold. The proportion of water varies according to the consistence of the liquor required, which differs for different purposes. The product is a gummy liquor, similar to the solution of gum-senegal in water, and its principal uses are a substitute for that gum.

The most general object for which dextrine is used, is in the printing and dressing of silk, cotton, linen, and other fabrics; in painting or printing paper hangings, in all sorts of distemper painting, in stiffning the different fabrics which require it, such as gauze, and in all the preparations which formerly required the use of starch and calcined starch, calcined farina, or British gum; also in the preparation of adhesive plaisters and bandages for surgical purposes, in glazing visiting cards and other papers; in short, it is a perfect substitute for gum senegal and other gummy and gum-like substances, in all processes of this nature, while it is much cheaper than any of them.

This is the substance recommended by M. Dumas as a varnish to protect the Daguerre pictures from injury.

MISCELLANEA.

Splendid Museum at St. Petersburgh.—The Emperor of Russia has approved of a design supplied by the Chevalier de Klenze, of Munich, for a new Museum for Sculpture and Pictures, and it is said the structure will probably be the most magnificent in Europe. It is to be attached to the Hermitage Palace, at St. Petersburgh. The entrance will be very striking, the giant figures of the Temple of Jupiter, at Agrigentum, in Sicily, having suggested its most prominent decoration. A superb staircase, with noble colonnades of marble or granite on each side, will lead to the upper range of galleries for the paintings, and no expence will be spared in order to make the museum exceed in splendour those of Berlin, Munich, or Paris.

Discovery of a Tesselated Pavement.—In a field adjoining the road leading from Rudston to Kilham, a tesselated pavement, about six inches from the surface, was uncovered—the tesseræ differing in size from one inch and a half to half an inch; colours white, red, and blue—white prevailing; laid in lines and forming diamonds, extending over a surface of about four yards by three yards, walled round on three sides with large rough stones, similar to the chalk stones of the Wolds. A great part of the pavement had been destroyed at a former period by some labourers who had dug it up in the hope of finding treasure, and the place filled up again promiscuously; it contained red bricks of a square form, $9\frac{1}{2}$ inches by $8\frac{1}{2}$ inches, $1\frac{1}{2}$ inch thick; pieces of plaster smooth on one side, and painted, some red all over, some in lines, and some with dashes of red and green, apparently water colours. Below this, at about $3\frac{1}{2}$ feet from the surface, were a number of tiles, in regular order, slightly curved, and having a flank at each side. They were placed flank to flank one with another, having the hollow side downward. The top surface presented an indented half circle, extending from one end to about one-third of the whole length. The size of each tile is about one-third of the whole length. These tiles measure about 15 inches by $11\frac{1}{2}$, and about three quarters of an inch in thickness. Immediately under these was another layer of the same sort of tiles, laid in the same manner, but transversely with each other. Below these was a small quantity of exceedingly black ashes, and near were some pieces of a rather honey-like substance, porous, and having a great semblance to the incrusted mass from the Dropping Well at Knaresborough. Still lower was a layer of fine rich earth, a few inches in thickness, and then a bed of fine natural red clay, probably the material similar to that of which the bricks and tiles had been formed.—*Hull Advertiser.*

Advantages of Railway Travelling.—So much for the mode of travelling; but the facilities which it will afford to pent-up citizens to migrate from their confined atmosphere, and dismal scenery of brick and mortar, into the fresh free air and beautiful expanse of the country, are still more important benefits conferred by railroads. Southampton and the Isle of Wight will be as near at hand as Richmond was in the days of yore; the balmy breezes and calm bays of Devonshire will be distant but a few hours' trip. Who then would deny himself the pleasure of beholding with his own eyes the beauties of his country, or pine in disease for want of healthful recreation? To a benevolent mind, the pleasure derived from travelling by railroad must be much enhanced by the consideration that the rapid, agreeable motion is produced by the action, not of sentient bone and muscle, but by that of inorganic, insensible agents.—*Curtis on Health.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 9, W. Ball, Esq., on the Comic Literature of the Kingdom (apart from the Drama). Friday, Oct. 11, T. Walker, Esq., B. A., on Astronomy. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 10, W. Maugham, Esq., on Lime, Baryta, and Strontia, and their use in the Arts. At half past eight.

ANSWERS TO QUERIES.

To take out the Stains of Red Ink.—Perhaps chlorine, or some of its preparations, will answer "T. R.'s" purpose. He can obtain sheet zinc in small quantities at any of the zink works in the New-road.

"Publico." All that is required to form ultramarine, carmine, or other colours into cakes, is a strong mucilage of gum tragacanth.

Naptha.—"F. P. H. T." is informed, that naptha may be procured from Spencer's in Fleet-street, from Robinson in the Minories, or from Cassell's, Mill-wall, Poplar, at from 3s. 6d. to 7s. 6d. per gallon, which will dissolve India rubber. If about one pound be cut up into thin shreds and boiled in water for a few minutes, then taken out and put in the naptha), which is better by being kept close covered, and the jar placed near the fire, or in a pan of boiling water; if stirred about once every hour, it will be fit to use in three hours' time. Should it be required very thick, less naptha may be used; but the above makes an excellent solution.

To destroy Warts, rub them every day with the inside of the broad Windsor bean shell.

"Henry" can refer to page 104; respecting nitrous oxide gas, to page 200.

I have generally found turpentine take out grease.

To make Hydrochloric Acid Gas.—Put a certain quantity of common salt into a retort that is made with a stopper on the top, then pour the same quantity of strong sulphuric acid on it, when a brisk effervescence will be produced, and white fumes will come over. This is the gas mixed with the atmosphere. To collect it, it is requisite to have a trough filled with quicksilver, and having a shelf fixed across the trough just beneath the surface of the quicksilver, with a hole fixed in it for a bait pipe to lead from the retort into the trough; the gas will be purified by passing through the quicksilver, and escape through the hole in the shelf, where it may be collected into a receiver placed over it. A Florence flask and tube would do equally as well as a retort.

I have read the article on "Penny Postage," and consider the plan of a stamping room an additional expense, no saving of time, and no doubt would create great and innumerable frauds, by allowing persons to take away letters after stamping and previous to their reaching the party addressed, thereby bearing the mark which is to be the proof in any dispute or litigation.

W. P. C.

TO CORRESPONDENTS.

W. P. C. *has our best thanks; the Index and Preface to Vol. IV., with Railway Map, &c., will be published on the 26th of October.*

T. L. M.—*We should advise him to address his memoir to the Post-master General, stating that it is a proposal of a plan for carrying into effect the Penny Postage Act. If he wishes any part, or the whole of his communication to remain secret, he may nevertheless have our opinion, and, if such be his wish, it shall not be published or otherwise divulged.*

W. S. C.—*If he will forward the papers on elementary chemistry, they shall be carefully examined, and, if possible, inserted.*

Our next being a double number, we shall be enabled to liquidate a considerable portion of the debt we have contracted with our correspondents.

A SPLENDID RAILWAY MAP!

With the MECHANIC AND CHEMIST of October 26th, will be presented (gratis) a

SPLENDID MAP OF ENGLAND AND WALES; showing, in addition to all the Principal Towns, the routes of the Railways through the various Counties; forming a handsome Frontispiece to Vol. IV. To ensure early impressions, give immediate orders to your Booksellers or Newsmen.

London: G. Berger, Holywell-street, Strand; and all Booksellers in Town and Country.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 53 & 54, NEW SERIES. | SATURDAY, OCT. 12, 1839. PRICE TWO-PENCE. | Nos. 174 & 175, OLD SERIES.

COLES' LOCOMOTIVE ENGINE.—Fig. 1.

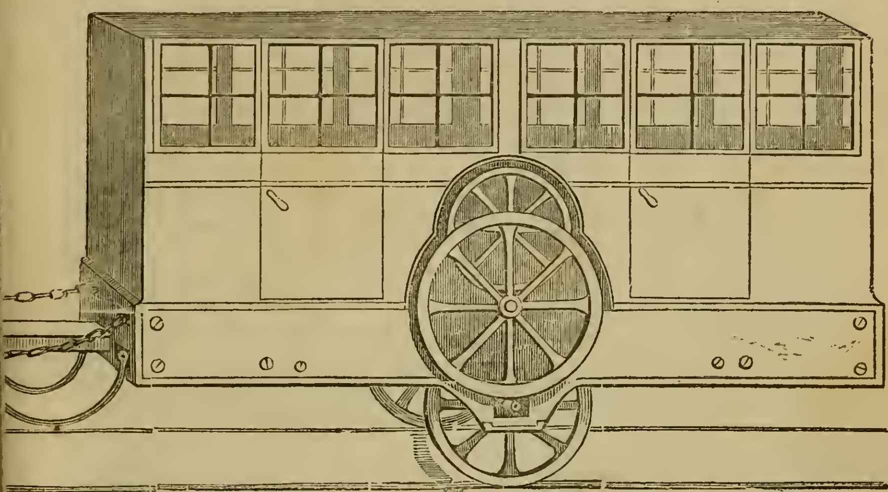
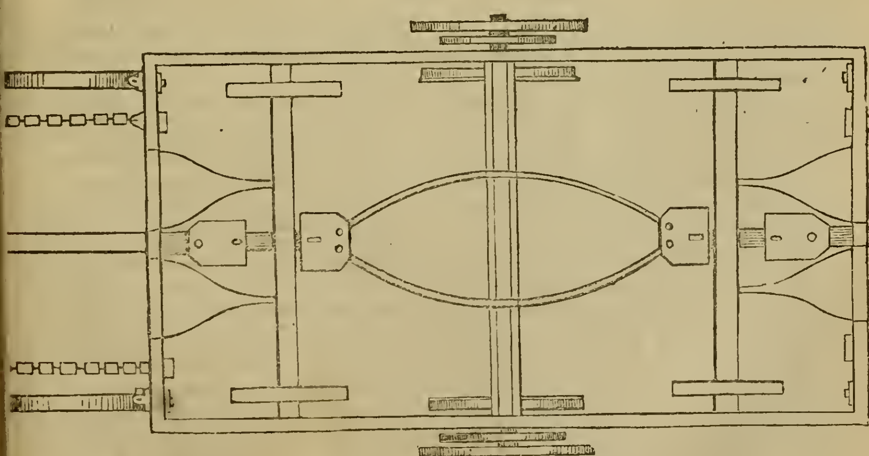


FIG. 2.

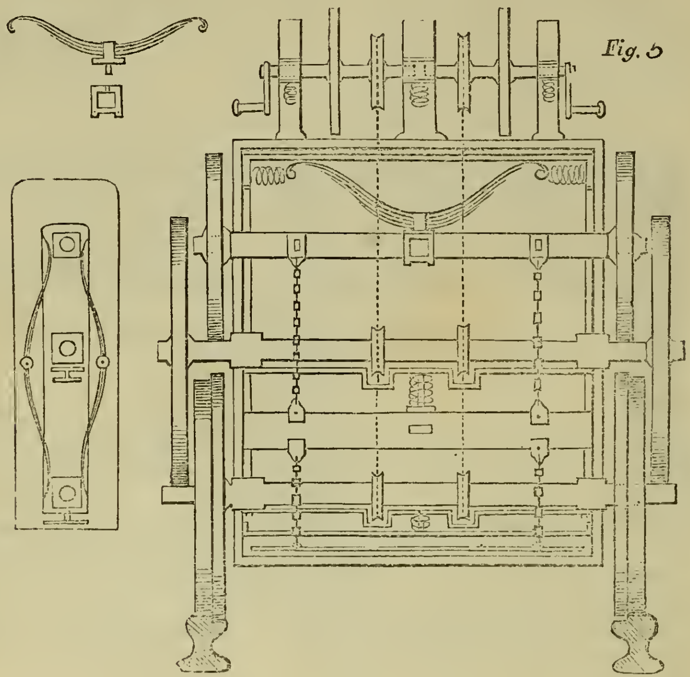


City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

COLES' LOCOMOTIVE ENGINE.

(See engravings front page.)

THE drawings (figs. 1 & 2) are from models of a two-wheel carriage, made upon a scale of one inch to the foot, for which patents have been obtained for the United Kingdom, France, and America. This engine is propelled by machinery (fig. 3), which works a pinion having a large



sheeve, with stubs at equal distances, the axle of the ground wheels having also a sheeve of half its size, and an iron chain working over them, with which there is no friction as with cranks; and when they are set in motion, the axle of the ground wheels, instead of bearing in the collar, works upwards against the rim of the large anti-friction wheels, and in like manner the axle of the latter is met by the rim of the upper wheels, which are in reality the friction wheels, as they revolve upon a fixed stub axle screwed to the frame-work of the carriage, which sustains the whole weight of the frame, body, and passengers. This carriage will traverse round a circle thirty-four feet six inches in four seconds, or at the rate of seventy-one miles in an hour, or propel one two-wheel carriage at the rate of fifty. They are constructed in a variety of forms, and are peculiarly adapted for working in mines, the bodies being made to carry their burden close to the rails or trams, if required, and tunnelling may in many cases be avoided.

" I shall proceed," says Mr. Coles, " to show how the friction between the flanges of the off wheels and the rail when working curved lines may be dispensed with; and, what is of still greater importance, viz., every two-wheel carriage in the train is a locomotive, capable of propelling a train by manual labour. Two men would propel four two-wheel carriages laden with passengers, the mails, &c., whilst the heavy goods may be conveyed in the four-wheel carriages. Manual labour is better adapted to work them than horses or steam power, as neither could resist their progress when descending; and trains of ten or twenty carriages may be propelled at the rate of forty or fifty miles in one hour with perfect safety, and without producing a heated axle, as the upper friction wheels relieve all the lower wheels

of their friction, and revolve but once, while the ground wheels revolve seventy-five times; of course there could not be one hundredth part of the wear in the working wheels. The friction is now so trifling in the axles, that every ton will draw four hundred tons when working on a level surface. It is generally admitted that there is greater friction between the flanges of the wheels and the rails in particular curves, than in the bearings of the axles; and when I have shown that carriages may be constructed that they shall not come in contact with the rail, the resistance would be so trifling, that manual labour will compete with steam, they could do more work, and with greater speed and safety, and with one quarter the per centage that is now paid for steam power. The labour required to work a hand locomotive, would be almost a sinecure when compared with sawing timber, threshing corn, and stable-boys' work, which the common labourer once had to perform (and of which he is now deprived by the introduction of steam), as six miles out of seven are either flats or descents, and where inclines do not exceed one in two hundred and fifty, they are as easily worked by hand as flats; their power to control, propel, or restrain their velocity, would be almost without limit.

To make four-wheel carriages work curves voluntarily, all the wheels must run outside the frame of the carriage; whilst the ground wheels of the two-wheeled carriage run inside the frame, the upper axle-tree must have a hole in its centre an inch and a half in diameter ; a cross-stay must be fixed to frame, having a pivot in its centre; and the axle would move round it; another cross-stay must be fixed to frame under the axle of the ground wheels, having a pivot two inches thick, and a similar pivot would be fixed on the centre of the buffing bar; two strong bars of iron must be fixed underneath the collars or bearings of the axles of the middle and ground wheels from one end to the other ; a hole would be made in the centre of each bar to receive the pivots on which they would move in right angles with the curves. The point of resistance is thus taken from the sides of the frame, and conveyed to the pivots in centre of axle trees ; two arms would be bolted to each of those bars, and meet each other in the centre, forming a knuckle-joint ; and when the fore wheels enter a curved line, the joint would act upon the hind wheels, and force the axles more distant on the outer curve, and closer together on the inner one, sufficient room being left in the groove where the collars work, to allow them to go an eighth part of an inch either way, or more if requisite. This may be termed a voluntary, self-acting principle; it is exceedingly simple, and admirably adapted for working curves on railroads. Two-wheel carriages do not require these improvements. I have also invented two other plans by which the wheels may be forced into a curve with mathematical correctness; and they are particularly adapted for common roads, to be propelled by manual labour, without the aid of horses or steam. The springs above the upper axle-trees are not to carry the burden, but to press the wheels down upon the rails, and to relieve them from any sudden jerk, when rebounding after passing over any uneven surface. If those springs were dispensed with, the upper axle must have been fixed to the frame, and when the machine passed over an unlevel surface, the wheels would drop, and the axles of the large wheels when rebounding would come in contact with the rims of the upper wheels, and abuse them. The springs have a rivet in their centre, the head of which would fill the hole in the axle and form a pivot, a hole being made in the centre of the upper axle to receive it: these pivots stand perpendicularly over each other, forming so many separate hinges, around which all three axles, with their wheels, would move; each axle bar would have two loops extending behind, and a bolt would pass through the loops, that they should all move together when working curves. Notwithstanding this improvement in the arrangement of the machinery, some slight alteration must be made in the present rails which form the outer curve, to enable the wheels to act correctly, viz., either an additional flat rail, laid down lower than the present rail, so that some portion of the outer wheel shall run alternately upon the rim of the wheel and upon the rail : the flange of the wheel may be about two inches thick and one inch deep. I would not allow more than a quarter of an inch play between the flange of the wheels and the rails. By the adoption of this plan, whatever the inner wheel gains gradually, the outer wheel, by running on its flange and taking a larger sweep, shall gain by degrees."

The velocity of steam carriages is so much greater than that of carriages crawling along the old roads, that many causes of resistance that are inconsiderable in the latter, become serious impediments in the former. The friction, and consequently the resistance on the axles of the working

wheels, though of secondary importance when compared with many other obstacles which are opposed to the attainment of high velocities, is, nevertheless, a subject worthy of consideration. The plan proposed by Mr. Coles, though less perfect than the old construction of anti-friction wheels (on account of the lateral friction he has introduced, by substituting the bearing upon a single wheel, for the angular bearing formed by the intersection of two circumferences) must, to a certain extent, produce an advantageous result; but he certainly overrates both the importance of his invention, and the inconvenience resulting from the construction at present adopted; and he even imagines difficulties which do not really exist. He says:—

"I thought nothing could be more inconsistent than to make such heavy carriages, and to carry such heavy burdens upon four bearings, when required to travel with so great a speed as they would be capable of doing, if made upon a much lighter scale, as the axle will swell with heat, and the collars would grasp their axle, and have no space for the oil to lubricate their bearings—in fact, they would become *immoveable* if their speed be continued."

Mr. Coles appears to forget that the collars are exposed to friction as well as the axles, and will also expand; so that the alterations in the relative diameters of the collar and axles, is only the excess of temperature of the one, above that of the other, which, considering that the utmost absolute expansion of the axle's diameter can scarcely amount to one five-hundredth part of an inch, and that of the collar, if not exactly the same, so nearly approximating to it, that the difference can only be appreciated by the most careful and accurate experiments; we are somewhat surprised at the assertion of Mr. Coles, that the wheels would "become immoveable if the speed were continued."

There is another assertion, still more unexpected than the foregoing, and which we cannot pass over unnoticed: we are informed that "where inclines do not exceed one in two hundred and fifty, they are as easily worked by hand, as flats"—the precise power required, and the most successful manner of applying it for working flats, we leave to Mr. Coles by experiment to determine; but that a rise of one in two hundred and fifty can be accomplished without the application of any more power than is required, *cœteris paribus*, on an horizontal line, is a doctrine which no engineer in this kingdom, except Mr. Coles, would venture to propound.

Mr. Coles is also remarkably unfortunate in his invention of a railway for curves of a short radius: the inconvenience and great danger which must result from the outer wheel "alternately resting upon the rim of the wheel and upon the rail" will always exclude that scheme from practical application. The following is the opinion and recommendation which we published in "the Mechanic" No. 37, July 27:—"A railway curve of half a mile radius, is bad and dangerous. Curve lines should never be laid on a plane surface; if the velocity of the train were invariable, and the outward rail raised to the proper height above the inner one, the engine would have no inclination to quit the line of rail, since the force of gravity would incline it inwards, as much as the rectilinear tendency of its momentum would incline it outwards. This effect may be exemplified by a very simple experiment:—In a bowl, or any concave spherical surface, project a round smooth ball, as a shot, or marble, taking care that the impulse be given in the direction of a tangent to an horizontal circle; the ball will revolve in a circle nearer to, or farther from the centre, according to the velocity of its projection. Now if a rail were formed in this circle, and a body moving upon wheels substituted for the ball, it is clear that that body, so long as its velocity is maintained by any force acting tangentially to the circular path, will move freely in the curve or circle, without tending in any degree to deviate from it. The great difficulty to be overcome in railway curves, proceeds from the inequality of the velocity of the trains; but assuming an average speed, and giving the rails a corresponding concavity, the inconvenience may be reduced to a small amount, unless the curve be of unreasonably short radius."

NEW ROTARY STEAM ENGINE.

At the recent meeting of the British Association, Mr. Gossage, of Stoke Prior, near Bromsgrove, read the following paper:—"A characteristic of the rotary engine, as originally constructed, is, that the whole of its parts revolve in the same direction, and that in whatever position of the revolution, its power is always the same, and the relative position of those parts which traverse or move in contact with each other is also the same. Any wear, therefore, which takes place, tends to increase the perfect fitting of the engine. The chamber in which the steam exerts its

alastic force, is the segment of a sphere, having conical ends, the points of the cones being towards the centre of the sphere; which arrangement forms an annular chamber. This channel is intersected by a segmental piston, or steam stop, which is fitted to the two cones, and also to the spherical part of the chamber, revolving steam-tight against the ball. A passage is formed through the lower cone, on one side of this piston, for the admission of steam, and a similar passage is formed on the other side for its escape; the communication between which is effected by a vertical shaft. If, therefore, no further means were provided, the steam would pass at once from the inlet passage, through the circular channel, and escape by the outlet passage, without yielding any mechanical force. The extent to which power can be obtained, is in proportion to the prevention of the escape of steam from the inlet to the outlet passage, except in consequence of the action of the engine, which action takes place after the steam has exerted its full force in impelling the piston. The prevention of this free passage of steam through the annular chamber, is effected by a circular disc or plate, which surrounds the ball, and extends to the periphery of the spherical chamber, to which it is made steam tight by metallic packing. This disc is so placed, that a radial line on its upper side is in contact with the upper cone of the chamber, and a radial line on its lower side is in eqnal contact with the lower one. The disc is mounted on a shaft, which, being supported at one end by a bearing placed at a suitable angle to the central vertical line of chamber, provides for the two sides being at the same time in contact with the upper and lower cones. As each revolntion of the steam chamber and the disc must be effected in the same time, and as their axes are placed at an angle to each other, different radial lines of the disc and cones will be brought into contact with each other during these revolutions; and any given point of the disc will be continually travelling from the upper to the lower cone, during one half of the revolution; and from the lower to upper during the other half. The consequence of this traversing motion is, that smaller chambers are continually forming, from the intersection of the main chamber by the disc and piston. These chambers serve for the reception of actnating steam from the boiler, the steam being prevented from communicating with the outlet passage, in one direction by the piston, which divides the annular chamber, and in the other by the close contact of the disc with the upper and lower cones. One of these chambers increases in capacity in direct proportion to the revolntion of the engine, until one half of each revolution is performed, when, by the change in the relative position of the disc and cones, the steam received is discharged; and, at the same moment that this change takes place, the formation of a new chamber for the reception of the steam commences. The chambers formed on the upper and lower sides of the disc are always in communication with each other, through the slit in the disc; and, therefore, the whole area of the piston on the one side, is in constant communication with the actnating steam, whilst this area on the other side, is also in communication with the outlet passage; and, consequently, the power obtained is uniformly alike. As the construction provides that the revolution of the disc and cones, in contact with each other, should effect the necessary alternate communication of the actuating chambers with the inlet and outlet passages, it will be apparent that the valves which are reqnired for effecting these changes in the reciprocating engines are dispensed with; and the whole power obtained being commnnicated to the rotating shaft, to which the steam chamber is attached, it may be applied at once. Thus, the moving parts necessary, merely consist of a spherical chamber, with its two cones and a shaft, a piston, and a disc with its ball and shaft, the two nozzles and stnffing boxes for the passage of steam, the bearings for the two shafts, and the framework. The perfect action of these rotary engines depends upon the precision with which the fitting of the two sides of the disc against the upper and lower cones can be accomplished, and the continuance of this precision when the engine is working. As a matter of workmanship, it has been fonnd that this precision is attainable with engines in which the steam chamber revolves on its own axis, and the two shafts revolve in fixed bearings. There are, however, circumstances connected with the action of the steam, which tend to effect a separation between the disc and cones, and thereby to admit of the passage of some steam without prodncing an equivalent mechanical force. During one half of the revolution, the area of the lower side of the disc, which is exposed to the full pressure of the steam, is greater than that of the upper side, which is similarly exposed. During this period, the pressure of the steam has a tendency to raise the disc from absolute con-

tact with the lower one; and during the other half of the revolution, a similar effect is produced on the upper side of the disc. The extent to which this effect can be produced must be extremely minute; as, to admit of its recurring at all, it is necessary that an actual compression of the metals, or a bending of the disc, must take place, as it is seen that the disc should be prevented leaving the lower cone by its contact with the upper one; and the reverse. Notwithstanding this, it is found that one half of each side of the disc, and one half of the surface of each cone, have constantly a polished surface, from their bearing against each other; whilst the other halves have no indication of being in absolute contact—thus proving that the effect before described does take place. One of the inventors of the new engine (Mr. Davies) was led, by the consideration of this action, to devise means by which leakage between the cones and disc might be prevented; and the further advantage secured, of rendering unnecessary that mathematical precision of adjustment, which was before required for obtaining the contact of the cones and disc. The principle consists in the adaptation of teeth, or cogs, to the disc and cones; these teeth being so arranged as to work into each other with great accuracy, in the same manner as the teeth of bevelled wheels. With this arrangement, instead of having a single radial line of contact between each side of the disc and the upper and lower cones, a number of teeth on the disc are in gear with an equal number of teeth on the cones; and as the suitable angle for the two axes is obtuse, this number may be extended to as many as seven teeth in gear at once. Thus, there are provided seven lines of contact in place of one; and as this contact of the teeth with each other is lateral, instead of being the contact of a flat plate against a round surface, any movement occasioned by the unequal pressure of the steam on the two sides of the disc, will only affect the depth to which the teeth are in gear, without disturbing the perfect fitting secured by their contact. For the sake of illustration, the disc and cones may be considered as bevelled wheels: it will be found that the diameter of the disc is considerably greater than that of the cone; yet these, if acting as wheels, must have an equal number of teeth, to secure their performing a revolution in the same time. According to the ordinary construction of the teeth of wheels, it would have been impracticable to effect this object; and it was, therefore, necessary to devise a mode of construction suitable for this purpose. On considering the manner in which the best constructed wheels work together, the inventor perceived that the form considered the best might be made available; the only modification requisite being the adoption of one portion, or the point of the ordinary tooth, for the larger wheel,—and the other portion, or its root, for the smaller. This modification being followed, the steam entering the chamber on the actuating side of the piston, will have a tendency to cause the disc to revolve on its own axis, in the direction contrary to that in which it should be impelled by the action of the engine; the amount of this tendency being dependent on the sectional area of the disc, multiplied by the pressure of the steam. The tendency of the disc to revolve on its own axis, is overcome by its teeth being in gear with the teeth of the cones; the power necessary being communicated through the teeth, which are retained in contact with each other, whilst the amount of resistance is not sufficient to occasion any material wear. The modification in the construction provides for an engine having only one moving part, viz., the disc; and this part moves in such a position, with regard to those with which it comes in contact, as scarcely to admit the possibility of any derangement occurring. Although this description applies to non-condensing engines, the same principle is equally applicable to those in which the steam is condensed. For this purpose, it is only necessary to provide a smaller machine of the same construction; which, being connected with the condenser, and actuated by the engine, performs the duties of the air-pump, with the advantage of its action being constant, instead of alternating, as in the reciprocating engine. The advantages derived from this application consist in the simplicity of the engine, which renders it much less liable to derangement than ordinary, and in the reduction in weight and bulk, as compared with the engines now in use.

MODES OF WATERING HORSES.

When the horse is at home, he is watered either in the stable from a pail, or in the yard from a trough, which, in racing establishments, is provided with a stout lock-fast cover as security against poisoning. In general, the horse seems to care little how he gets the water; but some will drink only from the trough, except when very thirsty. I know of no objection to

the trough, provided it be kept clean, and that the horse does not tremble after drinking from it. The water, however, is often very cold, and the man is often so very lazy, that he is unwilling to bring the horse to the door, and he makes two services stand for three. When the horse happens to be in the yard, he may get his water before going in; but at other times it is as well to make it a rule that the water be carried to the stable. Coming from a warm stable to the open air, and drinking cold water, the horse is apt to take a shivering fit. Each stable should be provided with water-pails always full, and standing in the stable.

In watering with a pail, the bucket is either placed on the ground, or raised manger-high to the horse's head. Old short-necked horses drink from the ground with difficulty, yet they always manage it. When the throat is sore, and when the horse is stiff after a day of severe exertion, his water should be held up to him. Some horses rarely drink well, and the less they drink the less they eat. They often require a little coaxing, and always a little patience. It is not enough to offer water and run away with it immediately. Hold the pail manger-high, and keep it before the horse for a little; after washing his mouth and muzzle he may take sufficient to create an appetite.

Post-horses are often watered on the road. They usually receive a little at the end of the stage, and also in the middle of it, if exceeding nine or ten miles. On the way home, the post-boy permits the horse to drink once or twice at watering troughs by the road-side. He does, or should endeavour to have, his horses fully watered, and cool by the time they arrive at stables. They are then ready for dressing and feeding without delay.

Horses are often taken to water at a pond or river some distance from the stables. If they need exercise or are passing the water, there is no objection to this practice. But it is not proper to send working horses out of the stable for the mere purpose of watering them. The weather, the state of the ground, and the laziness of stablemen, render this mode of watering extremely irregular. Boys, too, are often employed in this service, and they are never out of mischief.

With many grooms it is a common custom to give the horse some exercise after drinking. Some give him a gallop, while others are content with a trot or canter for a few hundred yards. Exercise after a copious draught of cold water is very useful. It does not warm the water in the horse's belly, as the groom says; but it prevents the evil effects which I have adverted to, in connexion with the temperature of water. Motion generates heat, and that which unites with the cold water can be better spared than if the horse were motionless. But the exercise need not be work. It is sufficient if it produce the least perceptible increase of warmth on the skin in eight or ten minutes. The man sometimes starts from the water at a gallop, but no good groom is guilty of this folly. Let the horse walk away for a few yards; from a walk he may proceed to a trot, and from that to a canter. In warm weather a walk is sufficient, and the pace need very seldom exceed a slow trot. The object is, not to heat the horse, but to keep him warm, to prevent shivering.

Water is not often given more than three times a-day. But in hot weather, when the horse sweats much, he often needs more water than it is safe to give at only three services. He should have it four or five times, and the oftener he gets it, the less he will take at once. Under ordinary circumstances, two rules will guide the groom. The first is, never to let the horse get very thirsty; the second, to give him water so often, and in such quantity, that he will not care to take any within an hour of going to fast-work. Water should always be given before, rather than after corn.

Broken-winded horses are usually much restricted in their water. I know that in stage-coaching they are not the worse for having as much as they please at night, provided it be given at twice or thrice, and not too cold.—*Stewart's Stable Economy.*

REVIEW.

A TALE ABOUT A GIANT AND A DWARF.

Extracted from a clever little Work, entitled "Chemistry no Mystery;" or, a Lecturer's Request." By John Scoffin. London: Harvey and Darton.

[We shall give some further account of this amusing and instructive volume next week.]

Of all the merry-makings which it has been my lot to see, none has ever pleased me so much as a village fair. The Lord Mayor of London's show, the King's visit to Parliament, and all other fine sights

put together, never afforded me half the gratification that I have felt from being present at a country fair. But my recollections of *all* country fairs are not pleasant, as will appear in the course of the tale which I shall presently relate; although I am convinced that the chastisement which I then suffered for an act of wauton mischief, taught me a useful lesson for my guidance in after life. It taught me in a practical manner something which I had heard theoretically advanced many times before: that knowledge is power, either for good or for evil, and is only conducive to happiness when enlisted on the side of virtue.

In the early part of June, some sixty years ago, I was present at the annual fair of my village. I was then about ten years old. The approach of the fair-day was a subject of pleasurable anticipation for every one within a dozen miles of the place: the village cottages were white-washed; the rose-trees were pruned; the garden walks were nicely weeded, and brushed clean from leaves; the cottage-doors were painted; and, in short, everything was done that could make our homes more comfortable or more neat; for the fair-day was one of hospitality to all strangers; and to have received them in negligence or untidinesss, would have seemed to us the height of ill-breeding. It was a pleasing sight for us boys, when perched upon the cottage roofs, or seated on the bough of some tall tree, to watch the busy preparations which were making for the approaching festivities. Some were employed in partitioning off the village-green into square divisions for the cattle: some were erecting booths for sweetmeats and toys, and some were fixing swings and round-abouts; while in another part of the green the village authorities were in earnest conversation with mountebanks, showmen, conjurers, and fruit-sellers, respecting the price which each should pay for a certaiu space of ground. No statesmen, settling a treaty between nations—no warriors, inspecting the field of an approaching battle, could look more serious and sedate than these: if their very lives had depended on the termination of the conference, they could not have looked more grave. The heads of some were moving from side to side; the heads of others were moving up and down; some grasped their pockets convulsively, and turned on their heels; some curled their lips and counted their fingers: in short, a careful observer, placed far enough away to be out of hearing, but still within sight, might have seen depicted in their ever changing gestures, all those varieties of feeling which are manifested in the course of mercantile transactions of the most extensive kind.

Far beyond this busy scene the horizon was clouded with rising dust, caused by the approaching cattle and caravans. In a short time they were distinctly visible, and in the space of a few minutes more, we saw them descend the hill immediately opposite to their place of destination. The cattle galloped and frolicked as if they too enjoyed the approaching festivities; and so perhaps they did, for none of them were tired from long travelling, having merely come from adjoining farms; and if they could be pleased with their own fine appearance, and experience a little of human vanity in being gazed on and admired, they must have felt pleasure indeed: be this so or not, they *did* appear pleased; why I cannot tell. Now came donkies, with gingerbread, fruits, and toys; carts, with mountebank-stages, balancing poles, swings, and round-abouts; then followed caravans with wild beasts, penny-peeps, giants, and dwarfs; next the more humble punchinellos, dog-cart men, and blind fiddlers; who, having allowed the aristocracy of the craft to advance before, now followed in the rear. The bells all the time continued ringing merrily, and thus passed away the evening.

Now I must suppose the night spent; not in sleep, at least, by me, for I was too anxious; however it *was* spent, and the fair-day had arrived, which brings me to the subject of my tale. I am sorry to own, that when young I employed my little stock of scientific knowledge chiefly in playing practical jokes, and this propensity did not entirely leave me until the fair-day, which I am now about to describe. Scarcely waiting to finish my breakfast, I sallied out with some of my young friends in search of adventures, and passing along a row of show-caravans, I was struck with the appearance of a picture, representing a giant and a dwarf, who were to be seen inside, together with a boa-constrictor and an alligator, all for the sum of one penny. Attracted by the harmony of a kettle drum and a cracked trumpet, a larger crowd of spectators surrounded this caravan than any other; and the managers were enjoying in consequence an undue monopoly. The wild-beasts' men in vain bawled forth the names and nations of their wonderful animals. Punchinello jabbered to the empty air, and the mountebanks danced and grimaced in vain; the giant, dwarf, alligator, and boa-constrictor were all the rage; and

the trumpet and kettle-drum drew wondering crowds into the caravan. "I have sartinly seed many a bigger fellow than he," said a countryman, stepping out. "If I beant mistaken," continued another, "the feller is on stilts, and if a body could make un come out upon the ground and show his inches fair and undeceitfully, he would look a wonderful different man." I do not know how it was, but this conversation aroused in me the most pleasurable sensations: I reasoned myself into a belief, that if there was any deceit in the matter, I should act properly in exposing it, by exhibiting the giant in his full proportions. When the mind is bent upon the performance of some mischievous trick, we first quiet conscience by endeavouring to clothe our evil propensities in a garb of virtue;—so was it with me; I fancied, that by drawing the giant out I should exhibit any deceit that there might be; and if there should be no deceit, then the giant might walk in again. But my conscience was not quite satisfied upon this point, inasmuch as the dwarf too must certainly experience some inconvenience if my proposed measure should be carried into execution:—perhaps also the alligator and snake might suffer. However, I had determined that the giant *should* come out, and conscience in vain whispered—no.

Returning home, I selected a basin—provided myself with ingredients for making this disgusting sulphuretted hydrogen, and filling the basin with nuts, the better to disguise my schemes, I crept stealthily under the giant's caravan, where, having set on the preparation of my gas, I retreated as fast as I could, allowing the noxious stench to ascend through the cracked and separated flooring of the caravan. Standing at a little distance on a hillock, I watched the result. "Walk in, ladies and gentlemen," bawled the conductor; squeak" went the trumpet, "bang" went the kettle-drum; but all in vain, the ladies and gentlemen kept walking out instead of walking in; their faces contorted and their notes compressed. Presently the musicians too left their posts, for the stench was intolerable. Another moment, and the ground was cleared for the space of many yards around the caravan; that is to say, all had left it but myself, who, standing on the little hillock, was enjoying a sight of the mischief which I had created. Whilst I was one of the crowd, my ecstacies, for aught I know, might have remained unnoticed; but standing alone they must necessarily have been remarked, and, indeed, so they were. Presently the dwarf gave a convulsive shriek—the giant roared aloud, and bursting from the caravan with the dwarf clinging tightly round his neck, he jumped from the platform to the ground, where heaving his great chest, and staring wildly around, he looked like an infuriated being from another world. Whether irritated by my laughter, or guided by an instinctive sense to the person of his tormentor, I know not, but leaping towards the hillock on which I stood, he snatched me in an instant from the ground.

I now repented of my joke, for he clawed and shook me about as a cat does a mouse;—a sound drubbing I would not have cared so much about, but the monster almost strangled me;—his great hands squeezed me so, that I thought every bone in my body was broken. Cry I could not, for he closed my mouth by main force, in order that I might be tortured with greater effect. He did not strike me, it is true; if he had, I think I must have died; and in this forbearance he was generous, well knowing his own immense strength; but having clawed me for a minute or two, he very coolly held me under one arm, my head towards the ground, and my feet kicking aloft; while the dwarf on his shoulder was busily engaged in belabouring my back and sides with a cudgel; a task which he executed with great perseverance and effect, exerting at every blow his utmost strength: *he* not being at all afraid of breaking my bones. Even this treatment was a relief to me, because I could cry. The people were panic-struck, and what with the horrible smell, and what with fear of the giant, no one came to my assistance; indeed I did not deserve that they should. How the rest of the day passed, I know only from hearsay: feverish and delirious I found myself two days afterwards in bed, surrounded by two doctors and a nurse. Six weeks passed, and I was yet unable to walk from the effects of my squeezes and bruises: however, I suffered no lasting injury, and I have many times since then been thankful that my fondness for practical joking experienced such a timely and salutary check.

From what I have been told, the giant really looked as large outside the caravan as he did inside it, and he did not require the aid of stilts to increase his height. As to his strength, I can offer personal testimony. But the sun has set, and I have reached my abode, therefore good night to you all."

A Treatise on a Box of Instruments and the Slide-Rule, with the Theory of Trigonometry and Logarithms; to which is appended, an easy method of imprinting useful Numbers on the Memory. For the use of Schools, the Mechanic, and the Engineer. By T. Kentish. London, Relfe and Fletcher, Cornhill, 1839.

We can confidently recommend this little Treatise as a valuable acquisition to young geometers; in explaining the use of the different instruments, the elements of several branches of mathematical science are exhibited with remarkable lucidity. As an example, we extract the following concise account of logarithms —a subject too frequently surrounded with a mist of obstruseness impenetrable to the uninitiated:

" Logarithms are a series of numbers in arithmetical progression, corresponding to another series of numbers in geometrical progression: thus—

0	1	2	3	4	5	6	7	8
1	2	4	8	16	32	64	128	256

where the indices 0, 1, 2, 3, &c. in the arithmetical series, are the logarithms of the numbers 1, 2, 4, 8, &c. of the geometrical.

" On examining these, it will be found that if any two of the logarithms, or indices, are added together, their *sum* will be the logarithm or index of the *product* of the numbers to which they belong. Thus, 2 and 3 are 5; the number against this is 32, which is the product of 4 and 8, the numbers beneath the indices 2 and 3.

" In like manner, if any one of the indices be *subtracted* from another, their difference is the index of the *quotient* of the numbers. Thus, 5 from 7 leave 2, the number against which is 4, the quotient of 128 by 32.

" For the same reason, if any one of the indices be *multiplied* by another denoting any *power*, the product will be the index of that power. Thus, to find the square of 8; its index is 3, which, doubled, becomes 6, the index of 64, the square of 8, as required.

" Lastly, if the index of any number be *divided* by the index of any *root*, the quotient will be the index of that root. Thus, to find the square root of 16; its index is 4, the half of which is 2, which is the index of 4, the square root of 16, as required. From which it appears that addition of logarithms answers to multiplication of common numbers, subtraction to division, multiplication to involution, and division to evolution. The same will also be the case if we select any other geometrical series; thus—

0	1	2	3	4	5	6
1	3	9	27	81	243	729

or—

0	1	2	3	4	5	6
1	10	100	1000	10,000	100,000	1,000,000

From which it is evident that the same indices may serve for any system, and, consequently, that the varieties of systems of logarithms are infinite."

Trigonometry is treated in an equally brief and masterly manner; and the whole volume is characterized by clearness, brevity, and accuracy. We not only wish but predict distinguished success to the author.

A New Derivative Spelling Book, in which not only the Origin of each Word is given from the Greek, Latin, Saxon, Dutch, French, Spanish, and other Languages, but also their present acceptation, with the parts of Speech accurately distinguished, and the Syllables accented agreeably to the most correct Pronunciation. By J. Rowbotham, F. R. A. S. London: Harvey and Darton, 1839.

It is a prevalent opinion amongst tradesmen and others who depend upon their own exertions for the possession of the comforts of life, and a respectable position in society, that the study of language is an ill-advised loss of time, and its object, if ever attained, of little or no utility in promoting the more important objects of commercial or operative undertakings: a closer examination of the subject must, however, soon convince us that the command of accurate, and consequently pleasing and elegant language, is a matter of paramount importance in almost every transaction in life; in negotiating the most momentous business, and in the corteous expression of conventional civility; in the heat of our quarrels, and in the confidence of friendship and affection; in the house of sorrow, and at the festive board, language must ever be the interpreter of the mind, or the advocate of our cause; we therefore hail with pleasure every successful attempt to facilitate the acquirement of so valuable a treasure. The little volume before us is eminently calculated to create a desire for more learning, and, considering its small dimensions, contains in itself a great quantity of valuable information. The derivation of each word, and the literal meaning of the original words are given. The Greek words are written in corresponding English characters, thus avoiding the necessity

of learning, or referring to the Greek alphabet. A few examples must convince the reader that this mode of instruction cannot fail to impress upon the mind that correct idea of the meaning and force of a word, which is necessary to its proper and judicious application:—

"A′-tom, s.; *atŏmŏs*, not divisible, from *a*, not, and *tĕmnō*, I cut;—a particle of matter so small that it cannot be divided or cut.

"Cyn′-ic, s.; *kunikŏs*, dog like;—a morose, snarling fellow.

"Mon′-arch (pronounced *mon-ărk*) s.; *mŏnŏs*, one, alone, or single; and *archē*, ruler, or governor; a sovereign who is invested with supreme authority."

It must be recollected, that this book is not intended as an introduction to foreign languages, and, accordingly, they are only introduced as connected with, or explaining English words. The Greek and Latin prepositions employed in the composition of English words, will be found a profitable study. The pronunciation of French words and phrases is difficult, and often impossible to express by any combination of letters, according to their sound in English. The sound of the French *je*, which occurs (with an almost imperceptible shade of difference) in the English words *grazier*, *leisure*, &c., is written *sjĕh*, which can hardly suggest so simple a sound. The French *s* and *x* often take the sound of *z*, as *beaux esprits*, *soi-disant*, *vis à vis*, &c., pronounced bo-zes-spree, swah-de-zang, ve-zah-ve; these are written with an *s* instead of a *z*, which produces the effect of an unpleasant German accent. It would exceed our proper limits to discant upon the various contents of this little volume; we therefore conclude by recommending it as, taken altogether, far superior as an elementary book for schools, or as imparting a tinge of conversational erudition to those who have concluded a plain education, to any other work of the kind we have ever seen.

Walks and Wanderings in the World of Literature, by the Author of "The Great Metropolis." 2 vols., post 8vo Saunders and Otley.

As in our frequent search after entertainment, the Author of the "Great Metropolis," has never failed to gratify our taste, we were glad with the invitation to accompany him in further "*Walks and Wanderings in the World of Literature.*" We anticipated a treat, and can assure our readers, we were not disappointed. Our author has enlivened his rambles with such a pleasing variety of useful and entertaining narrative, as cannot fail to make every reader wish his present volumes the same success as his previous works have had.

THE CHEMIST.

ACIDS.

NO. III.

Chloric Acid may be prepared by passing a current of chlorine through a mixture of oxide of silver and water; chloride of silver is produced, which is insoluble, and may be separated by filtration. The excess of chlorine, which the filtered liquor contains, is separable by heat, and the chloric acid dissolved in water remains. Chloric acid may also be obtained by adding dilute sulphuric acid to a solution of chlorate of baryta, as long as it occasions a precipitate. The baryta is thus separated in the form of an insoluble sulphate, and the chloric acid remains in aqueous solution. Care must be taken to add no more sulphuric acid than is requisite, for any excess contaminates the chloric acid. If the exact proportion has been used, the chloric acid is neither rendered turbid by dilute sulphuric acid, nor by chlorate of baryta. If either of these occasion a precipitate, they must be carefully added till the effect ceases; the clear liquid may then be decantered or filtered off. Chloric acid is a sour colourless liquid; it forms no precipitates in any metallic solution. It is decomposed by hydrochloric and sulphurous acids and by sulphuretted hydrogen. Its compounds are called *chlorates*.

Chlorocyanic Acid.—If pure cyanuret of mercury in powder is moistened, and exposed, out of the presence of light, to the action of chlorine in a well-stoppered phial, in the course of a few hours bichloride of mercury and chlorocyanic acid are formed. The bottle is then cooled to 0°, by which the chlorocyanic vapour is solidified. Chloride of calcium is introduced, the stopper replaced, and the bottle moderately warmed, that all the water may be absorbed by the chloride. The vapour is then resolidified by a second exposure to the freezing mixture, and in this state the bottle is filled with mercury, and a bent tube properly attached, so that on applying to it a gentle heat, the chlorocyanic acid may be collected in an elastic state over mercury. At 0° it crystallizes in transparent needles, between 6° and 12°, or under a pressure of four atmospheres; at 60° it is a limpid colourless liquid, and

at temperatures above 12°, under ordinary pressure, it acquires the state of permanent vapour or gas, excessively irritating to the eyes and organs of respiration. Water dissolves about 25 volumes of it, alcohol about 100 volumes, and ether about 50; but its solution does not redden litmus when pure, and when free from cyanogen and hydrochloric acid, it does not render turbid a solution of nitrate of silver.

Chromic acid is most easily procured by the decomposition of the native chromate of lead, which may be effected by reducing it to a very fine powder, and boiling it in a solution of potassa or soda. An orange-coloured solution of the alkaline chromate is thus formed, to which sulphuric acid is to be added. On evaporation, crystals of chromic acid are formed along with the sulphate of soda or potash; or the acid may be formed by adding nitrate of baryta to the chromate of potash, and subsequently decomposing the chromate of baryta, which falls by sulphuric acid. Chromic acid is of a dark red colour, its taste is sour and metallic; it tinges the cuticle yellow. It may be obtained from its aqueous solutions in deliquescent prismatic crystals of a ruby colour. It dissolves in alcohol, and the solution gradually deposits green oxide. With muriatic acid it forms a compound which dissolves gold. Its compounds are called *chromates*.

Cinchonic acid may be obtained by boiling the yellow cinchona bark in water acidulated with sulphuric acid, filtering aud adding to the warm liquors recently prepared, moist hydrated oxide of lead till they are perfectly neutralized, and acquire a yellow colour. The yellow liquid contains a little cinchonate of lead, a considerable quantity of cinchonate of lime and quina, together with some colouring and extractive matter. The lead is separated from the yellow solution, either by a little sulphuric acid or by sulphuretted hydrogen. The liquor is filtered and the quina precipitated by a very slight excess of lime. What now remains, dissolve in nearly pure cinchonate of lime; it is evaporated nearly to the consistency of a syrup purified by precipitation with alcohol, and decomposed by oxalic acid, added drop by drop. Cinchonic acid furnishes a colourless aqueous solution, which, when concentrated, becomes yellow brown. It is sour and slightly bitter, and difficultly chrystalizable. It forms salts called *cinchonates*.

Ferro-chyazic acid may be obtained by dissolving 58 grains of crystallized tartaric acid in alcohol, and pour the solution into a phial containing 50 grains of ferrocyanate of potassa, dissolved in three drachms of warm water; by these means the potassa is precipitated in the state of supertartrate, and the ferro-chyazic acid remains in the alcohol, from which it may be obtained by careful evaporation, in small cubic crystals. It is decomposed by a gentle heat, or strong light, in which case hydrocyanic acid is formed, and a white hydrocyanate of iron is deposited,

Fluoric Acid.—When finely-powdered fluoride of calcium, or fluor spar, as it is usually called, is distilled with twice its weight of sulphuric acid, a highly volatile and corrosive liquid is obtained, which acts powerfully on glass and most of the metals. The retort employed in this experiment must be of lead, as also the receiver. The receiver must be immersed in a mixture of ice and salt. The product is best preserved in a silver bottle, with a well-fitted stopper of the same material. When pure, it is clear and colourless, very volatile, and smokes when exposed to the air; at a temperature above 60°, it flies off in vapour. Its specific gravity is about 1.0609, but by the gradual addition of a certain quantity of water, it acquires a considerable increase of density, the mixture having a specific gravity of 1.25. Its attraction for water far exceeds that of the sulphuric acid, and when dropped into water, it excites a hissing noise, and great heat is evolved. Its vapour is dangerously pungent and irritating, and the liquid acid is eminently active upon the skin, produces a painful sore, and in larger quantities dangerous, and malignant ulceration; hence the vessels containing it require to be handled with the greatest caution. Its most characteristic property is the energy with which it acts upon glass. Its vapours soon destroy the polish and transparency of all neighbouring glass vessels, and when dropped upon glass, great heat and effervescence are produced, and dense flumes evolved, consisting of fluosiliric acid. Diluted with about six parts of water, the acid may be used for etching upon glass, which it very effectually accomplishes in a few minutes. Its compounds are termed *fluates*.

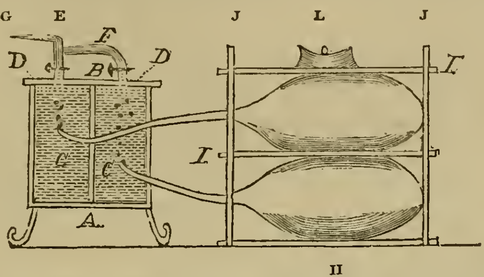
J. MITCHELL.

The lovers of English art will rejoice to learn, that David Roberts has returned from his wanderings in the East, laden, as they will be sure, with matter for their future delight.

MITCHELL'S OXY-HYDROGEN BLOWPIPE.

To the Editor of the Mechanic and Chemist.

SIR,—Should you think the following description of an oxy-hydrogen blowpipe, which I have invented, worthy of notice, you will oblige me by inserting it. It has, I think, advantages over those I have hitherto seen. It combines safety and convenience. It can also be applied to the production of the oxyhydrogen light, by projecting the flame on lime. A, is a square metallic vessel, which may be made of sheet iron painted. It is separated in the middle by the partition, B; the spaces, C C, containing water; D D is a double wire gauze, covering the tops of each partitions; E and F are two pipes communicating with each other, as seen in the diagram. The point, G, is the blowpipe jet; H is a square stand, made of



wood; the pieces, I I, slide up in the rods, J J; between the pieces, I I, are placed bladders containing the oxygen and hydrogen; the weight, L, on the top, is for the purpose of keeping up a constant stream of the gases, each of which pass through their separate portion of water, thence through the wire gauze to the pipes, each of which is furnished with a stop-cock, so that the gases are not mixed until the moment of ignition; from whence it will be seen, that explosion is next to impossible; the wire gauze prevents the flame from igniting the large portions of gas in the bladders, and the water affording an additional security. The hydrogen to be turned on first and ignited, then the oxygen.

I remain yours, &c.

J. MITCHELL.

ADVENTURE WITH A SERPENT.

A CORRESPONDENT of the Madras Herald gives the following account of an adventure with a cobra di capello, which occurred to a gentleman who was reposing under a tamarind tree alone, after a day of shooting:—" I was aroused by the furious baying of my dogs: on turning round, I beheld a snake of the cobra di capello species, directing its course to a point that would approximate very close upon my position. In an instant I was upon my feet. The instant the reptile became aware of my presence, in nautical phraseology, it boldly brought to, with expanded hood, eyes sparkling, neck beautifully arched, the head raised nearly two feet from the ground, and oscillating from side to side, in a manner plainly indicative of a resentful foe. I seized a short baboon, left by one of the bearers, and hurled it at my opponent's head. I was fortunate enough to hit it beneath the eye. The reptile immediately fell from its imposing attitude, and lay apparently lifeless. Without a moment's reflection, I seized it a little below the head, hauled it beneath the shelter of the tree, and very coolly sat down to examine the mouth for the poisoned fangs of which naturalists speak so much. While in the act of forcing the mouth open with a stalk, I felt the head sliding through my hand; and, to my utter astonishment, became aware that I now had to contend against the most deadly of reptiles in its full strength aud vigour. Indeed I was in a moment convinced of it; for as I tightened my hold of the throat, its body became wreathed round my neck and arm. I had raised myself from a sitting position to one knee; my right arm, to enable me to exert my strength, was extended. I must, in such an attitude, have appeared horrified enough to represent a deity in the hindoo mythology, such as we so often see rudely emblazoned on the portals of their native temples. It now became a matter of self-defence. To retain my hold it required my utmost strength to prevent the head from escaping, as my neck became a purchase for the animal to pull upon. If the reader is aware of the universal dread in which the cobra di capello is held throughout India, and the almost instant death which invariably follows its bite, he will, in some degree, be able to imagine what my feelings were at that moment; a shudder, a faint kind of disgusting sickness pervaded my whole frame, as I felt the cold, clammy fold of the reptile's body tightening round my neck. To attempt any delineation of my sensations, would be absurd and futile: let it suffice, they were most horrible. I had now almost resolved to resign my hold. Had I done so, this tail would never have been written; as no doubt the head would have been brought to

the extreme circumvolution to inflict its deadly wound. Even in the agony of such a moment, I could picture to myself the fierce glowing of the eyes, and the intimidating expansion of the hood ere it fastened its venomous and fatal hold upon my face and neck. To hold it much longer would be impossible. Immediately beneath my grasp, there was an inward working and creeping of the skin, which seemed to be assisted by the very firmness with which I held it; my hand was gloved. Finding, in defiance of all my efforts, that my hand was each instant forced closer to my face, I was anxiously considering how to act in this horrible dilemma, when an idea struck me that, was it in my power to transfix the mouth with some sharp instrument, it would prevent the reptile from using its fangs, should it escape my hold of it. My gun lay at my feet, the ramrod appeared the very thing required, which, with some difficulty, I succeeded in drawing out, having only one hand disengaged. My right arm was now trembling from over-exertion, my hold becoming less firm, when I happily succeeded in passing the rod through the lower jaw up to its centre. It was not without considerable hesitation that I suddenly let go my hold of the throat, and seized the rod in both hands; at the same time bringing them over my head with a sudden jerk, discharging the fold from my neck, which had latterly become almost tight enough to produce strangulation. There was then little difficulty in freeing my right arm, and ultimately throwing the reptile from me to the earth, where it continued to twist and writhe itself into a thousand contortions of rage and agony. To run to a neighbouring stream to lave my neck, hands, and face, in its cooling waters, was my first act after dispatching my formidable enemy."

Improvement in the mode of constructing Steam Engine Boilers.—The *Newcastle Journal* says, we have recently had an opportunity of witnessing the application of an improvement made by Joseph Price, Esq., glass-manufacturer, of Gateshead, in the mode of constructing steam engine boilers, by which, with a consumption of coal, less than one-quarter of that commonly employed, the same quantity of steam was generated. The peculiarity of construction lies in the interior of the boiler, the flue of which is made to pass several times through its entire length, thereby economising the heat, and producing at the same time, a current of air equally strong, as would be caused by a perpendicular chimney of the same length. The boiler, which we saw, was attached to an engine of about ten-horse power, with twenty and a half-inch cylinder, and was working at about $1\frac{1}{4}$ lbs. pressure to the inch. The consumption of coal averages about two tons weekly, which, with an ordinary boiler, producing the same power, would be somewhere about eight or nine tons. There are other important advantages possessed by Mr. Price's boiler over those in ordinary use, and which recommend it to the attention of scientific and practical men.

Important to Miners.—Professor Graham, at the meeting of the British Association, made an important practical suggestion, which may be the means of saving many lives. He observed that the *after damp*, or carbonic acid, left in the atmosphere of a mine after an explosion, is supposed to occasion, in many instances, a greater loss of life than the explosion; at the same time, it renders assistance impracticable. In many cases the oxygen of the air is not exhausted by the explosion, although, from the presence of five or ten per cent. of carbonic acid, it is rendered irrespirable. The atmosphere will be rendered respirable by withdrawing carbonic acid, and he suggested a method by which this may be effected. He found that a mixture of slacked lime and pounded Glauber salts, in equal proportions, has a singular affinity for carbonic acid; and that air might be completely purified from that deleterious gas by inhaling it through a cushion of not more than an inch in thickness, filled with that mixture, which could be done without difficulty. This lime filter would be an additional source of security wherever the safety lamp is necessary, and it should be invariably employed by persons who descend into a mine to afford assistance to the sufferers.—*The Lancet.*

Eyes of Insects.—The most remarkable arrangement regarding the eyes of animals is observable in the vision of the insect races. In this instance the eye is fixed to the head; whether because there is not room to turn it conveniently, or because another provision is better, is of no consequence. Such is the fact; and see how nature has compensated the want of the moving process. In the common fly, which offers a ready example, are seen two small round projections at the side of the head. These little dull protuberances are not single eyes. Each projection contains many thousands of eyes disposed in rows, each one of which is capable of transmitting an impression of outward objects; and by this means the fly can see as well behind as before, as well down as up, and is therefore put on its guard against attack. A German naturalist counted 6236 eyes in a silkworm. Another naturalist counted 14,000 in a drone fly, and 27,000 in a dragon fly. It has been proved by actual experiment, with the help of microscopes, that each one of these eyes was capable of receiving an independent and distinct impression. The inference seems necessarily to be, that the retina of these insects may receive, at the same time, some thousands of impressions without any confusion; which is far more wonderful than the single impression made on the retina of our own species, and on those of other animals, who have two eyes with a retina for each. The little insect or fly, that skims about so rapidly along pools of water, requires to see both upwards and downwards at once; and so nature has kindly provided for their comfort in this respect, by fitting a portion of their eyes on the upper part of the head, and another portion below; they hence see into the air and into the water at the same time.

Discovery of a Subterranean Chamber at Alton.—A number of labourers have lately been employed by the Earl of Shrewsbury in excavating part of the ruins of the ancient baronial castle, which forms the chief ornament of this picturesque village. Amongst other trifling curiosities

they found some bullets and a piece of ancient coin; but a few days since they discovered a subterraneous apartment and a flight of stone steps, which apparently form a descent to the bottom part of the stupendous and lofty rock on which the castle is built. The excavation has since been suspended by order of the Earl, who intends to continue it to a still greater extent on his return to England next summer.—*Staffordshire Examiner.*

Splendid Viaduct.—The first stone of the viaduct at Congleton, on the line of the Manchester and Birmingham Railway was laid with much ceremony on Wednesday week. In length the viaduct will be 3078 feet, or nearly a mile, 31 feet in width, and 27 feet between the parapets; the span will be 60 feet, with 20 feet rise. There will be 42 arches, which are segments of circles; and the greatest height from the river to the rails will be 98 feet 6 inches. The bases of the piers are intended to be of stone for about twelve feet in height above the ground; the imposts and parapets will also be of stone, and the rest of the structure of brick. The viaduct will contain about 61,000 cubic yards of brick-work, and about 586,000 cubic feet of stone-work, and is expected to be completed in two years and a half.

A Thunder Storm on the Summit of Loch Lomond.—About two hours before sunset, the sky, which was formerly unclouded, became suddenly overcast. Shortly after, a scene ensued of the most terrific kind: but few such scenes could ever have been witnessed in Europe. We found ourselves above the region of the clouds: they floated in the atmosphere beneath, and hovered over the surface of the mountains; anon succeeded a vivid flash of lightning, which was instantly followed by a peal of thunder, louder and more protracted, perhaps, than ever was before or since heard on British ground. Again and again, in forked and brilliant sheets, did the electric fluid flash; and again and again did the thunder peal, till its reverberations among the mountains seemed to us as if they had been the prelude to the disorganization of Nature herself. Our courage, I am free to confess, forsook us; we stood aghast at the appalling scene; we then felt, for the first time, the utter insignificance of man: we felt, moreover, as if we had been alone in the world. Happily, the elemental strife, after raging with such violence for about half an hour, began to subside, and we hastened to descend the mountain, seeking to calm our yet troubled spirits in the nearest house.—*Walks and Wanderings in the World of Literature, by the Author of "The Great Metropolis."*

An India-rubber Boat.—There has been just launched on the Neva, says a St. Petersburgh letter, an India-rubber boat. It is made of sail-cloth impregnated with caoutchouc. It may be rolled up, and in the space of ten minutes can be filled with air by means of four little cocks, by which inflation it assumes the form of a boat. During its trial on the river it held three persons, and excited much attention as well by the readiness of its movements as by its pretty appearance.

Wreck of the Royal George.—Immense quantities of the wreck of this vessel have been picked up since the great explosion of the cylinder containing 2,600 lbs. of gunpowder, the force of which is expected to have almost shattered the wreck to pieces. On Tuesday the mainmast was picked up by the pilot of the look-out vessel belonging to the *Netherlands Consul*, moored at Spithead, who conveyed it to the dockyard at Portsmouth. It has a most extraordinary appearance, and has excited very great curiosity. It is entirely covered with barnacles, all alive, some measuring eight inches in length.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 16, Rev. R. Vaughan, D.D., on the History and Antiquities of Athens. Friday, Oct. 18, T. Walker, Esq., B. A., on Astronomy. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 16, Quarterly General Meeting. At half past eight.

QUERIES.

1. In the making of water-colours, how are they formed into square cakes and stamped? 2. How to make Frankfort black? 3. How to make infusion of gentian, as it it sold in the chemists' shops? F. J. F.

How to melt brass in quantities of about an ounce to casl in moulds? I have tried several ways and have failed. G. G.

How to make red and green fire? G. R. C.

How to take stains out of crimson silk? F. J. T.

What materials are wanted to commence a brass foundry with? Can you give me a drawing how to build a furnace? How to melt brass on a small scale? Which is the best way to make a dividing plate for cutting tooth wheels? R. Cotton.

1. How to varnish plaster figures, so that they may be washed? I have seen some look like marble. 2. How to clean and polish shells? 3. How to prepare paper for painting on in oil? 4. The best way to take out rust and stains from polished steel articles? T. H.

The way in which a true ball or globe can be turned? H. S.

How to make carbonic acid gas? An early answer will much oblige A Subscriber.
9, Ernest-street, Regent's Park.

ANSWERS TO QUERIES.

To Remove Warts—"Alpha." Mr. Tyrrell in his lectures on astronomy recommends the application of a strong decoction of the root of the septfoil to cure warts, particularly when situated in parts of delicate structure, by destroying there peculiar vitality. For making the decoction

he recommends the following directions:—Boil gently an ounce of the fresh root of the septfoil, bruised in twelve ounces of water, till reduced to half a pint, and then strain off the liquor for use, After washing the warts with warm water three times a day, they must be kept constantly covered with lint moistened with the decoction.

P. T.

Hydrogen Gas.—"Alpha." Take a retort furnished with a glass stopper above, and put into it an ounce of iron filings, such as may be procured at any smith's or artisan's workshop; add to this four ounces of water, and then pour in four ounces of sulphuric acid. An action immediately commences between the substances, and a bubbling of air is perceived; this is hydrogen gas, which, if the glass stopper is put in, will pass over by the mouth of the retort, and may be collected by means of jars. If a retort is not at hand, a simple apparatus still may be used, such as a strong phial with a wide mouth, into which put the ingredients as above, and then fix a glass tube into a cork and put it into the phial; the gas will escape by the tube, and may be collected by tying a bladder on it; or if the tube is bent like the letter S, it may be used in the air trough. If a taper be put to the end of the glass tube, after the mixture has been some time in the phial, the hydrogen will inflame, and continue to burn as long as the action within continues; as a mixture of hydrogen and common air explodes with some force, care should be taken that no common air remains in the bottle when the taper is put to the tube; and as a farther security, the whole apparatus of the bottle should be rolled round with a coarse cloth.

P. T.

So Stain Ivory.—"J. Herrett." Ivory is stained a scarlet colour by boiling it in lime-water with brazil wood.

To Bronze Plaster Busts.—"W. M. B." will find several methods to effect his purpose in No. 100, Old Series. PROPORTIO.

Sulphate of Soda may be formed by the direct combination of sulphuric acid with soda. It is abundantly procured by the manufacture of muriatic or hydrochloric acid:—2lbs. of dried muriate of soda (common salt) 20 oz.; sulphuric acid; distilled water, 1 pint. First mix the acid with half a pint of water in a glass retort; add to these when cold, the muriate of soda; pour the remainder of the water into the receiver, adapting the retort to it, and distil by heat. What is left is sulphate of soda. F. PRICE.

TO CORRESPONDENTS.

W. L. S.—Homœopathy *is derived from the Greek οθος, like, and παθος, a suffering or feeling. It is so called on account of a pretended discovery that the cause of every disease is also its cure. Παθος, in the stoic philosophy, also signified mental perturbation, contrary to reason; in this sense it may be properly applied to the Homœopathists, for a more arrant piece of quackery was never imposed upon the credulity of man.*

Tyro Chemicus *will find a letter addressed to him at our office.*

J. T.—*The wax crayons are composed of pipe clay, or very fine white chalk, called French chalk, mixed with the required colour, and formed into the proper consistence with virgin wax, and, perhaps, a small quantity of turpentine, which will afterwards evaporate. The moist water-colour appears to be composed of animal gelatine, thickened with acid, as is practised in the manufacture of paste blacking.*

X. S.—*The Royal Society of London is the most timid, inert, and inaccessible of all similar societies in Europe. The value and sincerity of their praise may be estimated by their own declaration, which is as follows:—"It is an established rule of the Society,* to which they will always adhere, *never to give their opinion, as a body, upon any subject, either of nature or art, that comes before them. And, therefore, the thanks which are frequently proposed from the chair, to be given to the authors of such papers as are read at their accustomed meetings, or to the persons through whose hands they received them, are to be considered in no other light than as a matter of civility!"*

A Correspondent.—*Freezing mixtures are variously formed, and of various powers; the following may probably answer his purpose:—*

Muriate of Ammonia	5	*Thermom. sinks from* 50° *to* 40°.
Nitre	5	
Water	16	
Muriate of Lime	3	32° *to*—50°.
Snow	2	
Diluted sulphuric acid	10	—68° *to*—91°.
Snow	8	

The sign—signifies below zero.

A. Z.—*It is supposed by some, that the crackling noise which is heard upon bending pieces of tin, is produced by a portion of arsenic being contained in the tin; but recent experiments have shown that this is not the case. Tin, when broken, exhibits a grained or fibrous texture, and may also be granulated by agitation at the time of its transition from the fluid to solid state; the cause of the noise, is clearly a partial internal rupture, or rubbing of particles imperfectly united.*

We are still in arrears with our correspondents, but they shall have our earliest attention.

A SPLENDID RAILWAY MAP!

With the MECHANIC AND CHEMIST of October 26th, will be presented (gratis) a SPLENDID MAP OF ENGLAND AND WALES; showing, in addition to all the Principal Towns, the routes of the Railways through the various Counties; forming a handsome Frontispiece to Vol. IV. To ensure early impressions, give immediate orders to your Booksellers or Newsmen.

London: G. Berger, Holywell-street, Strand; and all Booksellers in Town and Country.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

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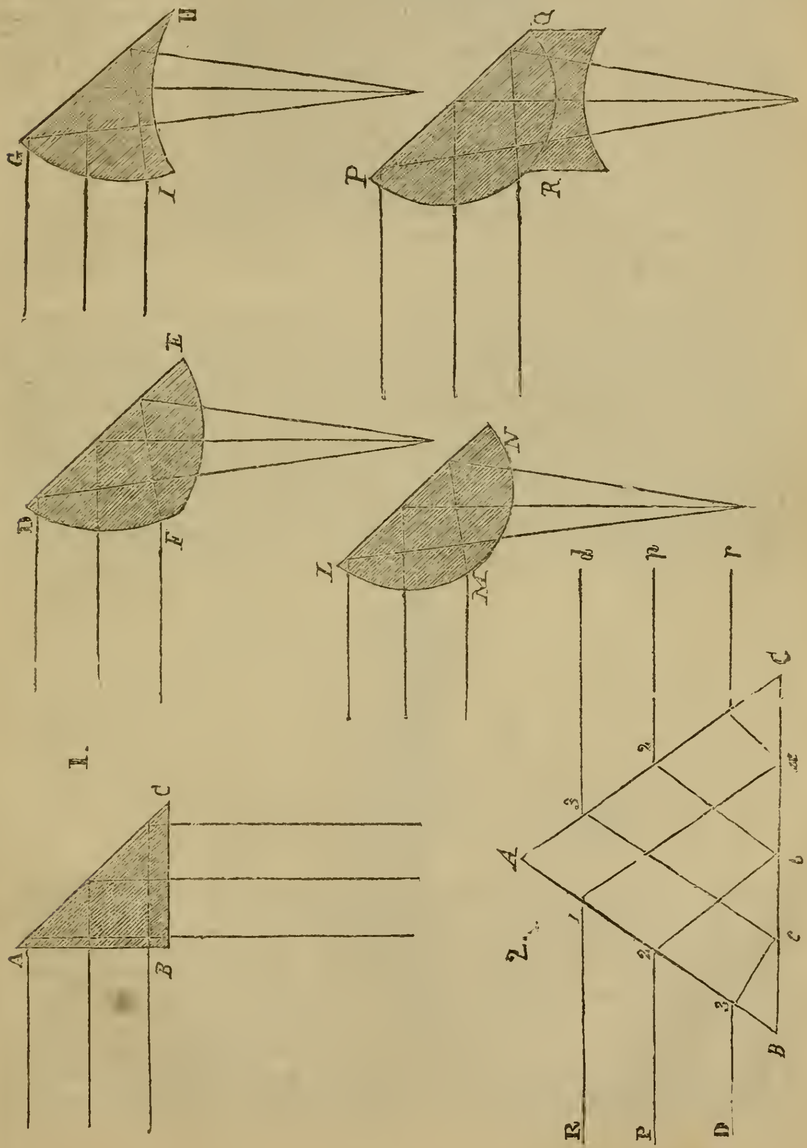
OPTICAL INSTRUMENTS.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

OPTICAL INSTRUMENTS.

NO. IV.

ON SIMPLE AND COMPOUND PRISMS.

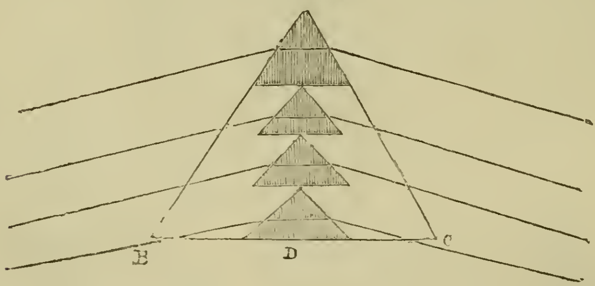
(See Engraving, front page.)

A RECTANGULAR prism, A B C, fig. 1, was first applied by Sir Isaac Newton as a plane mirror for reflecting to a side the rays which form the image in reflecting telescopes. The angles, B A C, B C A, being each 45o, and B a right angle, rays falling on the face, A B, will be reflected by the back surface, B C, as if it were a plane metallic mirror; for whatever be the refraction which they suffer at their entrance into the face, A B, they will suffer an equal and opposite one at the face, B C. The great value of such a mirror is, that as the incident rays fall upon A C at an angle, A C, at an angle greater than that at which total reflection commences, they will all suffer total reflection, and not a ray will be lost; whereas in the best metallic speculum, nearly half the light is lost. A portion of light, however, is lost by reflection at the two surfaces, A B, B C, and a small portion by the absorption of the glass itself. Sir Isaac Newton also proposed the convex prism, shown at D E F, the faces D F, F E, being ground convex. An analagous prism, called the *meniscus prism*, and shown at G H I, has been used by M. Chevalier, of Paris, for the camera obscura. It differs only from Newton's in the second face, I H, being concave instead of convex. On account of the difficult execution of these prisms, Dr. Brewster proposed to use a hemispherical lens, L M N, the two convex surfaces of which are ground at the same time, when a longer focus is required, a concave lens, R Q, of a longer focus than the hemisphere, P R Q, may be placed or cemented on its lower surface, and if the concave lens is formed out of a substance of a different dispersive power, it may be to correct the colour of the convex lens. A single prism is used with peculiar advantage for inverting pencils of light, or for obtaining an erect image from pencils that wonld give an inverted one. This effect is shown in fig. 2, where A B C is a rectangular prism, and R P D a parallel pencil of light, which, after being refracted at the points 1, 2, 3, of the face A B, and reflected at the points *a b c* of the base B C, will be again refracted at the points 1, 2, 3, of the face A C, and move on in parallel lines 3 *d*, 2 *p*, 1 *r*; the ray, R 1, that was uppermost, being now undermost, as at 1 *r*.

COMPOUND AND VARIABLE PRISMS.

The great difficulty of obtaining glass sufficiently pure for a prism of any size, has rendered it extremely difficult to procure good ones; and they have therefore not been introduced, as they would otherwise have been, into optical instruments. The principal upon which polyzonal lenses are constructed, is equally applicable to prisms. A prism constructed like A D, fig. 3, if properly executed, would have

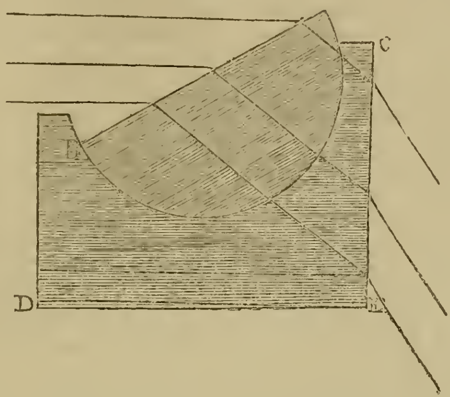
FIG. 3.



exactly the same properties as A B C, and would be incomparably superior to it, from the light passing through such a small thickness of glass. It would obviously be difficult to execute such a prism as A D, cut out of a single piece of glass, though it is quite practicable; but there is no difficulty in combining six small prisms all cut out of one prismatic rod, and therefore necessarily similar. The summit of the rod should have a flat narrow surface parallel to its base, which would be easily done if the prismatic rod were cut out of a plate of thick parallel glass. The separate prisms being cemented to one another, will form a compound prism, which will be superior to the common prism for all purposes, in which it acts solely by refraction. A compound prism of a different pencil, and having a variable angle, was proposed by Boscovick, as shown in fig. 4, where A B C is a

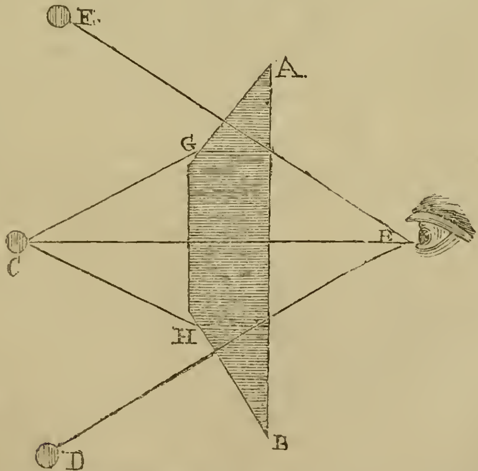
hemispherical convex lens, moving in a concave lens, D E C, of the same curvature. By turning one of the lenses round upon the other, the inclination of the faces, A B, D E, or A B, C E, may be made to vary from 0° to above 90°. As this apparatus is both troublesome to execute and difficult to use, I have employed an entirely

FIG. 4.



different principle for the construction of a variable prism, invented by Dr. Brewster, and have used it to a great extent in numerous experiments on the dispersive powers of bodies. If we produce a vertical line of light, by nearly closing the window-shutters, and view the line with a flint-glass prism, whose refracting angle is 60°, the edge of the refracting angle being held vertical, or parallel to the line of light, the luminous line will be seen as a brightly-coloured spectrum, and any small portion of it will resemble almost exactly the solar spectrum. If we now turn the prism in the plane of one of its refracting faces, so that the inclination of the edge to the line of light increases gradually from 0° up to 90°, when it is perpendicular to the line of light, the spectrum will gradually grow less and less coloured, exactly as if it were formed by a prism of a less and less refracting angle, till at an inclination of 90°, not a trace of colour is left. By this

FIG. 5.



simple process, therefore, namely, by using a line of light instead of a circular disc, we have produced the very same effect as if the refracting angle of the prism had

been varied from 90° down to 0°. Let it now be required to determine the relative dispersive power of flint glass and crown glass. Place the crown glass prism so as to procuce the largest spectrum from the line of white light, and let the refracting angle of the prism be 40°. Then place the flint glass prism between it and the eye, and turn it round as before described, till it corrects the colour produced by the crown-glass prism, or till the line of light is perfectly colourless. The inclination of the edge of the flint-glass prism to the line of light being known, we can easily find the angle of a prism of flint glass which corrects the colour of a prism of crown glass, with a refracting angle of 40°.

MULTIPLYING GLASS.

This lens is more amusing than useful, and is intended to give a number of images of the same object. Though it has the circular form of a lens, it is nothing more than a number of prisms formed by grinding various flat faces on the convex surfaces of a plano-convex glass, as shown in fig. 5, where A B is the section of a multiplying glass, in which only three of the planes are seen. A direct image of the object C, will be seen through the face G H, by the eye at E; another image will be seen at D, by the refraction of the face H B; and a third at F, by the refraction of the face A G; an image being seen through every plane face that is cut upon the lens. The image at C will be colourless, and all those formed by planes inclined to A B, will be coloured in proportion to the angles which the planes form with A B. Natural multiplying glasses may be found among transparent minerals, which are crossed with veins oppositely crystallized, even though they are ground into plates with parallel faces. In some specimens of Iceland spar, more than a hundred finely-coloured images may be seen at once.

A. D. M.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 382.)

AFTER passing under a bridge which carries the road from Leighton to Linslade, and proceeding through an excavation about a mile long and fifteen feet deep, we arrive opposite to Stock Grove, the seat of Colonel Hanmer; the canal flows close to the embankment, and the view obtained from this point is worthy of notice. The line now recedes from Bedfordshire, which county it approaches within about half a mile at the Leighton Buzzard station.

BEDFORD is an ancient borough town, 50 miles from London, and 23 from the Railway station; straw plait and lace are manufactured here, and the trade in corn and coal is facilitated by the river Ouse, which passes through the town. The town consists of one principal street about a mile in length, with many smaller streets crossing it at right angles. The opposite shores of the navigable river Ouse, are connected by a handsome stone bridge of five arches. Bedford has suffered much at different periods from the civil wars with which this country was formerly afflicted; it was more than once the site of cruel battles between the Danes and Saxons. It was besieged in the wars of the Barons, and of the revolution, and was alternately in the possession of each party —may the wisdom of succeeding generations preserve the land from civil discord!

The castle which formerly stood here is so completely destroyed, that a portion of the intrenchments is all that remains to corroborate tradition. The church, dedicated to St. Paul, is a spacious building, partly in the ancient, and partly in the florid or decorated style of architecture. It has a tower with an octagonal stone spire. There is an old chapel in this town, in which John Bunyan, author of "The Pilgrim's Progress," formerly preached: his chair is still preserved. Bedford formerly contained the tomb and chapel of Offa, king of East Mercia, a gentleman celebrated for his piety, and his munificence to the church; and, *per contra*, the kidnapping and murder of his brother saint, Ethelbert. Both tomb and chapel are now lost, being swept away by the encroachments of the river Ouse, which gradually undermined their foundation. Bedford gives the title of Duke to the Russel family. A market is held on Monday for cattle, and Saturday for corn and provisions; fairs, first Tuesday in Lent, April 21, July 5, August 21, October 11, and December 19. Races, September 27, two days. Alternate cuttings and embankments, with some interesting scenery from the latter, brings us to

THE BLETCHLEY STATION, an intermediate one, $46\frac{3}{4}$ miles from London, and $65\frac{1}{2}$ miles from Birmingham. Quitting the Bletchley station, the Railway proceeds upon an embankment, and crosses the great Holyhead road, by a massive brick and iron bridge, called the Denbeigh Hall Viaduct. This "Denbeigh Hall," which is no more than a miserable roadside public house, was dragged into notoriety by a temporary station and terminus of the Railway being established there,

before the whole line was completed. A journal of that time says, "It never, within the memory of man, was a coaching house, nor are there any proofs that the beauty of the bar-maid, or the soundness of the ale, ever induced any particular coachman to pull up there. Occasionally, a heavy broad-wheeled waggon or two might be seen standing before it, and it had a sort of minor fame among drovers." The circumstance from which the title of "Denbeigh Hall" originated, is almost as frivolous as the events which sometimes lead to the dubbing of men with equally applicable titles:—Many years ago, the carriage of a fine old gentlemen, a Lord Denbeigh, happened to stick in the mud in one of the fine old roads which abounded in those days. His Lordship took refuge in a neighbouring cottage, and at his departure bestowed a liberal reward upon his host; from that time, Ralph's hovel became "Denbeigh Hall." From the Bletchley station, the road is carried on a lofty embankment, affording a good view on both sides; to the west is the village of Bletchley, situated about a mile from the station. The church is an ancient structure, standing on an eminence, and approached by a noble avenue of yew trees. It contains several ancient tombs and inscriptions, which, though they convey no information of any utility, may afford much amusement to the antiquary. The view to the east discovers the villages of Great Brickhill, and Little Brickhill, and Bow Brickhill church, standing on the highest ground in the county of Bedford, being 683 feet above the level of the sea. It is surrounded by a delightful country, well furnished with wood. After passing the villages of Loughton and Bradwell, we arrive at

The Wolverton Station, 52½ miles London, 59¾ from Birmingham. This is the only station at which passengers are permitted to stop for refreshment between London and Birmingham. There are extensive workshops and foundries erected at this place for the construction of boilers, engines, carriages, &c., and for the repairs which are frequently required in the carriages or machinery when performing long journeys.

A GAMBLING ACADEMY.

Translated from the French for the "Mechanic and Chemist."

I met one day, says M. Decremps, in a coffee-house in London, a Frenchman, named Kussel, with whom I had formerly been acquainted at school. After the usual compliments, I asked him how he spent his time in London; he replied that he passed almost the whole of his time at the Academy. "I congratulate you with all my heart," said I, "and wish I had that happiness myself." "There is no great happiness in it," said he, "but, nevertheless, if you desire to become one of our companions, I could introduce you, and, presented by me, you would be received with open arms." I told him I had no claim to admission into an assembly of that kind; but he explained, smiling at my mistake, that the assembly into which he proposed to introduce me, was not a learned or literary society, but simply an academy of gaming, composed of swindlers of every species, who were alternately cheating and cheated. "Do not imagine," he added, "that I trouble myself about books as I did at college. Since I consigned my library to the flames, I have wandered about, earning a precarious living by every scheme and contrivance which my ingenuity could suggest. I was a butter merchant in Flanders, an actor in Brabant, scrivener, Latinist, and orthographist at Edinburgh, and fencing-master and teacher of music in Dublin. At present, after having changed my trade for the tenth time, I '*fais sauter la coupe**,' draw the card, inveigle the snipes, and pick the pigeons. In a word, if you desire to be initiated into my secrets, and serve me as a confederate at the Academy, you may soon say with me,

> "My pocket is a treasure;
> Under my happy hands, copper becomes gold."

I was as much shocked as surprised at the liberty he took in making this offer, and the boldness with which he boasted of his dishonest deeds; but such is the blindness of brazen-faced vice, that it often makes men boast of things which ought to make them blush. I replied, that I had long since learnt the theory of his art, not to put it in practice and to make dupes, but out of curiosity, and with the intention of one day denouncing to the public the various snares which are laid to entrap honest people.

"Since you are so knowing," said he, "perhaps you can explnin to me how it happens, that for the last fortnight I have constantly lost my money, notwithstand-

* This and the following are terms used by swindlers; "faire sauter la coupe," is a method of secretly replacing the cards in their former position, after they have been cut, or separated into two parcels.

ing the tricks I have practised, and am obliged to appear less frequently at the Academy, and to walk about, not to gain an appetite, but to beguile my hunger."

"It is not surprising," said I, "that you have been beat in your turn; cheats in gaming are like duellers; sooner or later they find their masters: there is, however, this difference, that professed fighting bullies recognize a certain point of honour, which prevents them from fighting two or three against one, while black-legs (*chevaliers d'industrie*) are often a dozen to devour one victim, and divide the spoils of the simpleton who is caught in their nets. One ingratiates himself with the servants of the house, and induces them to substitute marked cards for the ordinary ones; the occupation of another is to invent new snares, and entice the dupes by fair promises; a third manufactures all kinds of cards which may be recognized by the eye or the touch; some are made narrower or shorter than the others; some rougher, smoother, or of a different tint, by rubbing them with different substances; a fourth is continually exercising himself in making 'sauter la coupe,' false shuffling, and '*filer la carte*,' that is, to deal the second or third card instead of the first, when he perceives by some external mark, that the first card is a good one for him they intend to ruin. Another is placed opposite his confederate, behind the victim, to perform what they call the 'little service.' Expert in the art of signals, he changes at every instant the position of his fingers, to let his accomplice know the cards which he could not distinguish by sight or touch. Another, '*tirant la bécassine*' (drawing the snipe) associates himself with his intended dupe; plays against a third with whom he has an understanding, loses all his money, and affects the agony of despair, while he secretly rejoices in the anticipation of the portion of the plunder he is afterwards to receive. A *controleur* is appointed to keep account of the money which the receivers put in their pockets, to prevent them from cheating their confederates; this one makes a false statement for a promised bride, and the player cheats him in return by keeping all the money himself." Kussel soon perceived that I knew too much to require his lessons, and, at the same time, that I was too honest ever to put them in practice; nevertheless, upon his entreating me to accompany him for an instant to the academy, for the purpose of discovering the artifices which had been employed against him during the last fortnight, the proximity of the place where the assembly was held, and my desire to gain information, induced me to accept his invitation. We found assembled in the same place, noblemen, grooms, musicians, conjurers, tailors, and apothecaries. These gambling houses, said I to myself, are like tombs, all ranks are confounded; at the same time my conductor whispered to me the names and conditions of the persons who composed the assembly. "There in a corner," said he, "are the four persons who have won my money; two of them are great seigneurs *incognito*." They were playing at a game called *brelan*; and what was my surprise, when I recognized in one of the pretended "noble lords," a famous conjurer called *Pilferer*, whom I had known at the Cape of Good Hope. "He is," said I, "no doubt, the person who has won your money." "That nobleman," he replied, "so far from winning anything, loses very good-humouredly every day forty or fifty pounds." Being, however, persuaded that a conjurer would not go to a gambling house to lose his money, I conceived there must be some deep-laid plot, which I had, perhaps, never imagined. I therefore resolved to observe Pilferer, and placed myself near him, with my handkerchief carelessly held up to my face, that he might not know me; I soon remarked, that when he dealt the cards, one person had a *petit brelan;* but there was sometimes a greater brelan in the hand of another player, whose countenance appeared not unknown to me. I soon recollected that I had seen him in Africa, serving Pilferer as domestic, companion, and confederate. I immediately suspected that Pilferer dexterously made his confederate win, and affected to lose some trifle himself, in order to prevent suspicion; that the confederate, for the same purpose, never shuffled the cards himself, but allowed others to do it; and that Pilferer and his accomplice pretended not to know each other, to prevent the suspicion of any unfair conspiracy. It remained for me to discover the means which Pilferer employed to deal out good or bad cards, according as it suited his purpose. This discovery did not appear very easy, when I found that he did not substitute a second pack of cards, and before shuffling himself, he always gave them to some other player to shuffle; I, however, at last perceived, that before he gave them to other players to shuffle, he retained five or six cards in his right hand, and receiving back the pack to shuffle in his turn, he placed them adroitly, so as to make his accomplice

win. The reader will perhaps imagine, that this arrangement is impossible; but, like many other tricks which are practised by gamblers, it is but too certain and easy to those who are experienced in the vile practice. I do not describe the means they employ, because I pretend to warn my readers that there exists a dangerous art, of which they may become the victims; but I will teach no one the method of reducing it to practice. I am not combating a chimera, for I have often shown my friends the many false shuffles which may be adroitly and imperceptibly practised at piquet, brelan, and triumph; beyond this, I disclose the secret to no person whatever, and am contented to show the results which prove how imprudent it is to risk money at play with persons whose probity is not perfectly known.

As I was about to retire, Knssel entreated me to communicate to him the result of my observations; but I told him I should not risk embroiling myself in any unpleasant quarrel, by making it appear that I had gone there in the capacity of a spy, and by denouncing facts which would probably be contradicted by many of the persons present; I added, that I only desired to warn the public of the tricks which are invented from time to time to impose upon the unwary; and that after this notice, we may say to the dupes who complain of being cheated, and to the cheat who meets with a cheat and a half:—"*Perditio tua ex te*" (you are the cause of your own undoing.)

As I was going out, I found, in a kind of anti-chamber, two Italians who were speaking in the provincial dialect, in order that they might not be understood; one complained that game was very scarce; the other replied, that it was not surprising, since there were so many sportsmen. "You are right," replied the first, "I played at piquet the other day with a man who had the appearance of an imbecile or an awkward clown, and he was perhaps the cunningest fox in all Europe; during a full hour, I employed against him all the resources of my art, when at last I discovered by chance, that he was employing the same, and deeper tricks against me.

"Corsairs contre corsairs,
Ne font, dit on, leurs affaires."

(When corsairs against corsairs strive,
Their business can never thrive.)

SMUGGLING EXPEDIENTS.

At Folkstone, the focus of the fair trade, boats were fitted with hollow masts and outrigging, having a plug at the upper or outer end. A few fishing-lines or nets were put into such boats as a blind, the owner launched off, went to his cargo, drew up one or two tubs, decanted them into the hollow spars, re-stepped his masts, rowed boldly on shore, suffered his boat to be searched as usual by the blockade sentinel, then hauled her above high-water mark, turned her bottom up, and, carelessly shouldering the masts, according to the universal practice, trudged off, as it seemed, merely to lock them in some place of security, but, in reality to empty and dispose of their liquid contents. One man has been known to make five such expeditions daily, bringing on shore three half-ankers at each trip, thus averaging fifteen tubs, or forty-five gallons per day, and as several boats were so employed, the importation proceeded rapidly, till the secret was betrayed by a drunken smuggler; when a general search was made along the coast, and no less than eleven boats were seized in one day, the whole of which were forfeited, for having such places of concealment contrary to act of Parliament. This device being defeated, another was planned by a Jew, nicknamed Buffy, who was, and possibly is still, a very active agent in all these illicit transactions. Some hundred of tubs were prepared at Boulogne, their shape and colour being altered and disguised by a coating of Paris plaster, studded here and there with gravel, shells, or sea-weed, so that they resembled lumps of chalk, such as are found under cliffs upon the coast of Kent. A cargo of spirits, in tubs of this description, was carried across to Dover during the night, and dropped upon the sands above low-water mark, so as to be dry when the tide receded. The boat then put off to sea and disappeared; and soon after day-break one of the smugglers, attired in a carter's gaberdine, with a long whip upon his shoulder, drove carelessly past the blockade sentinel, proceeded down across the sands, and leisurely loaded his cart with what seemed lumps of chalk, intended for burning into lime; he then laid a few pieces of real chalk over the top, drove again past the sentinel into the fields, where the cart was unloaded in a twinkling, and the operation repeated, till every cask had been conveyed to a place of safety. As no boat appeared in this affair, and but one person attended the cart, there was nothing in the least likely to attract attention, or to excite the suspicion of the

sentinel. The scheme accordingly succeeded so well, that it might have escaped detection altogether, had not the secret been entrusted to a woman! Alas! that we should be compelled to record a circumstance so confirmatory of the freemason's prejudice—so hostile to the credit of the fairer sex—so derogatory to the dear, delightful, unretentive darlings; but we have a solemn duty to perform—truth is omnipotent and woman weak; yet

"Should to her share some trivial errors fall,
Look in her face, and you'll forget them all."

One of the Dover smugglers, in the exultation of success, confided their stratagem to his sweetheart, and the damsel in turn betrayed it to a more favoured lover, who happened to be an officer in the coast blockade service. This of course led to a discovery and seizure of the next cargo, and two of the plastered tubs were immediately sent along the whole line of blockade, to put the officers and sentinels upon their guard against any repetition of the stratagem.—*United Service Journal.*

ON BRIDLING AND BITTING HORSES.

(From the Life of Maceroni.)

A GREAT error which is now common with most horsemen and drivers (not military) is in the use of the bit. The bit is intended and constructed so as, with the assistance of the curb chain, to form a powerful lever, acting on the lower jaw, while the arch of the cross piece presses with violence against the roof of the mouth. For this purpose the curb chain must be sufficiently tight to keep the check pieces of the bit in a straight line with the line of the horse's face, when the arch of the cross piece will be in the same line, and not touch the roof of the mouth; but if the curb-chain be left too slack, the arch piece is always tormenting the roof of the mouth; and when the bridle is pulled, instead of acting on the chain and lower jaw, the checks of the bit come back on a line with the bridle, so nothing further than the action of a snaffle is produced by a bit a foot long. Thus it is that we every day hear of horses running away, "shocking accidents," fractured skulls, &c. Not so with the Turks, Arabs, South Americans, and those people who are the most celebrated in the management of horses. Talk to any of these of a horse running away with them they would not understand you, because they understand how to bridle a horse. It is a mistake to suppose, that by putting on the bit and curb chain as it ought to be, that therefore it is unpleasant and "hard" upou the horse's mouth. On the contrary, the bit is then kept steady, without the arch fidgetting the roof of the mouth. The rider is not bound to bear upon the bridle; but when he does pull the horse must obey. We all know how the Turks and Arabs will gallop up to you, or to a wall, and in the space of a yard or two stop their horse, stiff on all four legs, as though he had been suddenly turned to stone. I have been led into these remarks upon bits and stirrups principally by recollecting that Col. Taylor, shortly after I saw him at Naples, lost his life in Portugal at the battle of Vimeria (I think) entirely owing to the false arrangement of his bit. While gallantly heading a charge against the French, his horse leaped a ditch, or took to a pace which very few of his men could follow. He thus found himself almost alone, within a hundred yards of the enemy. All might yet have been well with him, had he been able to stop and turn his horse; but his bridle had no power; he was seen to pull it with all his might, without any effect; his horse carried him straight into the enemy's ranks; and they not knowing his dilemma, received him on the point of their lances or bayonets, so that he was killed. The kind of horse he rode, too, was not that fitted for war. It was a regular "hunter," long backed, necked and legged, full sixteen hands high—very different from the compact built horses now in use in the British cavalry. If I may be allowed to suppose it possible for Colonel Taylor to be thinking of any such matters during his fatal unwilling course towards the lances of the French, and it is most likely that he did think of bitts—and curse them too—most likely he thought of me at that dire moment. I had been in company with him at Naples, and held with him the conversation on bits and stirrups to the effect which I have here described.

While on the subject of horsemanship and bridles, I will take the opportunity of suggesting some other items to the consideration of such of my readers as are not irrevocably wedded to everything in usuage, merely because it is a usuage, and an old one, perhaps, into the bargain. In consequence of my habits of observation, I am of opinion that the use of "blinkers" to draught horses is more calculated to cause the evils intended to be guarded against. We prevent the horse from seeing in any other direction but straight before him, lest he should be frightened by some object on either side of him. I do

not understand the *rationale* of this. He is as likely to see, to him, alarming objects in front as any where else. Anything new in shape, or colour, or sound, affrights a horse; but when he finds that there is really no cause of fear, he is speedily reconciled. The horse is curious, and somewhat of an observer; moreover, he is formed by nature and inclination to see and constantly look behind him. This is indicated by the use of his heels, and by the necessity, in a wild condition, of fleeing from his enemies, the wolves and panthers. Now put a horse into a vehicle that makes much noise behind him—jingling, ringing, shaking,—he naturally feels anxious to look behind to ascertain the cause. If you approach a blinkered horse so that he cannot see you coming, and give him a sudden pat on the side or shoulder, he will start and tremble; but go up to him in front, and slap him ever so, he sees that there is no cause of fear, and does not stir. Supposing by some accident, a horse is left with a portion of a shaft, or any other fragment, dragging behind him, off he gallops, and is, he thinks, pursued by the dreadful thing following him, which he cannot see. At Naples, the hackney coach and cabmen use no blinkers to their horses; and I have observed for years the great advantages of the omission. Although these horses are generally spirited stallions, and sometimes vicious, never such a thing as their being frightened and running away occurs. Moreover, the horse keeps always one eye at least at the hand of the driver, so that the mere lifting of the whip is enough to make him pull, without its actual application. More might be said upon this subject, but brevity forbids me.

The "bearing rein" is an excellent device for taking from the horse a portion of his power of traction, and keeping him in a constant state of torment while in harness. The act of drawing requires the freedom of the neck, which should be allowed extension, instead of the chin being forced up to the throat. The constant pain to the horse's mouth, and the cramped muscles of the head and neck, are too evident to need discussion. We see the horses shaking, and shaking up their heads, and coachee gives them a good cut of the whip to ease them, I suppose, by substituting one sort of pain for another. Of course I shall be told of "the look of the thing," without "blinkers" or "bearing reins." Very well, then, go on using them. I have done my duty towards the steeds, by giving my opinion, which, I hope, others better qualified will enlarge upon.

PLANTS RECOMMENDED TO MORE GENERAL CULTIVATION.

Rhubarb.—Of the *rheum*, or rhubarb, there are several varieties, two of which especially deserve attention. They are known among cultivators as the *early scarlet*, and the *Goliath* or *giant rhubarb.* The former is valuable, as it may be gathered from three to six weeks earlier than any other sort, but the produce is small compared with that of the giant rhubarb, which, in the heart of a populous and smoky city, (where even the hardest shrubs cannot exist) produces stalks averaging more than 1lb. each. Rhubarb is of the same nature as the dock, (*rumex*) and will grow in almost any situation, if it has a rich and deep soil, and is kept free from other vegetation. The best way to cultivate this plant is to procure half an ounce of seed, which is very easily obtained; sow this in the months of March, April, or May, in a bed 10 feet by 4 feet, about three-quarters of a foot in depth; transplant in about ten weeks in a maiden, or else a well-manured soil, of at least 3 feet in depth, the giant 4 to 5 feet apart, the early 2 feet, and in the following year a considerable crop of full-sized stalks may be taken.

Sea Kale Beet, or *Silver Beet.*—This plant is totally different from the white beet, and is of recent introduction. It is entitled, by its wholesomeness and delicacy, as well as by its amazing produce and facility of cultivation, to a portion of every domestic garden. Unlike the mangel-wurzel, or red beet, which are of the same family, this plant has its produce *above ground*, the root being small and unimportant. The whole of the leaf is used. The leaf stalk, which is of an ivory whiteness, is separated from the green part, and boiled as sea kale, for which it is an excellent substitute, and whence its name; the remaining part of the leaf, when boiled, can hardly be distinguished from the finest spinach: and having the same virtues in a high degree, has been recommended by medical men as purifying and wholesome. It has besides this advantage, that one sowing, whatever the season, will yield an abundant supply for at least six months. The great difficulty in the growth of summer spinach is to prevent its running up to seed. This plant being biennial, does not flower till the second year, by which much useless labour and expense, incident to the growth of common spinach, are prevented. Early in April procure one ounce of seed for a bed of the richest soil, 30 feet by 6 feet, make holes 1½ in depth, and 1 foot apart in quincunx

order; (planted in a square, one at each corner, and one in the middle) into each put three or four seeds, and, if more than one come up, withdraw all except the finest plant. About the first week in June the leaves will be from 2 to 3 feet in length, and may be broken off close to the root for use.

The White Carrot.—This root, which is a new variety of the common garden carrot, *Daucus sativus*, is not yet much known. In colour it is something whiter than the parsnip: in flavour much more deiicate than the orange carrot. The seed may be obtained in London, and it will, no doubt, soon be in general cultivation.

Indian Corn.—The large white variety sow in a hot-bed in April, transplant into a rich soil, and water freely. As soon as the feathery substance, or filaments, are developed, cut the ears, (stripping them of the numerous sheaths) which, when boiled, are palatable and nutritious.—*Noble's Compend.*

HORTICULTURAL HINTS.

Improved Method of treating the Sc rlet Runner. As soon as the leaves show the signs of frost, carefully take up the roots, let them dry for a day or two in the sun, then bury them in dry sand, and keep them in a cellar through the winter; plant tnem again early in May, and they will produce a more abundant crop, with less vine, than seedlings; they may be so treated year after year, as this plant is perennial, but, like the nastardium and some others, destroyed by the severity of our winters.

The Cottager's Hot-bed Light.—Make a slight frame of two or three inches in width, to the size of the box, and tie across it strings dividing it into squares of about fifteen inches; paste together sheets of cartridge paper or newspaper sufficient to cover the whole, then paste and afterwards tack this to the outside of the light frame, letting it rest upon the strings. When perfectly dry, take a brush or sponge, and saturate the paper with linseed oil, which, when dry, will afford a congenial light to cucumbers, or even melons; retain the heat of the bed, draw the sun, and yet throw off the rays, and resist the weather for at least one season. Melons grown under such a light have carried the first prize for flavour and precocity at horticultural shows. Its economy is obvious.

Sparrows do more good than harm in a fruit garden, and the shots intended for their destruction much more harm than good, as any man of observation may see in the mutilated bark of the fruit trees on the one hand, and the insectivorous propensities of the sparrow on the other.

Fuchsia.——The different varieties of fuchsia are proved to be quite hardy. If planted in the borders they attain to a greater size than when kept confined in pots; and should the winter kill them to the ground, they will, in the summer, produce vigorous stems from the root.

Transplanting Trees.—In removing a tree, remember that every fibre is of importance, but especially the tap root, that is the perpendicular or main root; in proportion as this is injured, the tree will suffer. A seed set in favourable circumstances would in a very few years overtake a transplanted tree of ten or fifteen years' growth whose top root was damaged. Trees, when damaged, are often deprived of this great channel of nourishment, in order to make them produce a fibrous root. This end may be gained, but the loss of the tap root can never be repaired, consequently the tree will not attain its natural size and beauty. The most expeditious, economical, and productive method of forming a forest, would be to sow the seeds where they may remain to maturity.

Hoes.—The most useful kind of hoe for a garden is the Dutch hoe, made in the form of the letter D, in using which the operator is continually retreating before his work, instead of following and replanting the weeds by treading them in. We wonder it is not in more general use.

CURIOUS ANCIENT RECEIPTS.

To make China ink, or a curious black.—Take an ounce of lampblack, half an ounce of peach black, and one drachm of burnt endive, with a moiety of fig-leaf water, and another part of new milk, then add a little gum arabic, and being well beaten, for the mass into tablets for use.

To make a lasting walnut grain on any white wood.—The wood being very smooth, spread upon it seven or eight lays of strong glue till it become shining, then quickly give a good many blows with a wooden brush well wet in fair water, and the work will be perfected to admiration.

To counterfeit red coral.—Take the smoothest part of the horn of an ox; rasp it fine, then make a strong lye of wood ashes, and put the horn into it for five days, then take it out, add to it some vermilion dissolved in water; so put it over the fire to jelly and thicken, and form your figures with it in moulds, in such

shapes as you please, and when they are put into cold water they will harden, and look like natural coral.

To make any coloured hair black.—Take warm oil of tartar, dip a sponge in it, and rub over the teeth of the comb with it, and comb your head in the sun or by the fire; then, being dry, wash your head over with hyssop water, which will take away the scent of the oil, and in six or seven days so doing, the hair will be curious black.

To make crayfish red.—Rub them over with warm aqua-vitæ, and they will immediately turn red, though alive; and for a pretty trick, place some of the live ones in a dish among the boiled ones, and when the guests go to handle them at the table, and taking up a sprawling live one, they will start and wonder at it as much, as the story goes, as when Dr. Faustus by enchantment made a boiled calf's head bleat at the table, as the students were cutting it up.

To make a glue to hold against fire or water.—Mix a handful of quick lime in four ounces of linseed oil, boil them to a good thickness, then spread it on tin plates in the shade, and it will become exceeding hard, but it may be easily dissolved over a fire as glue, and will effect the business to admiration.

To make ink to rub out at pleasure.—Burn flax so that it may be rather mouldered than burned to ashes, then grind it with a muller on a stone, putting a little aqua-vitæ to it, then mix it with a little weak gum water, and what you write, though it seem fair, may be rubbed or washed out.

To make worms immediately come out of the ground.—Boil an ounce of verjuice in a quart of vinegar, and sprinkle a little on the ground where you suppose their beds are, and it will so disturb them, that they will immediately appear on the surface.

To hold fire in one's hand without burning.—Rub your hands with a good mixture of oil of vitriol, juice of plantain, and strong vinegar, and you may lay a piece of lighted charcoal in the palm of your hand, without feeling any sensible heat.

To make a candle that no wind will put out.—Run a small wick dipt in brimstone and saltpetre through a small reed, then cover the reed with wax, or tallow, and as fast as it blows out, it will, by the virtue of the brimstone and saltpetre, light again of itself, to admiration.

To make ink that will vanish in twenty-four hours.—Boil nut galls bruised, in aqua-vitæ, and put some Roman vitriol and sal armoniac to it, and when cold dissolve a little gum arabic, and it will effect your desire. This is an excellent ink for lovers that would not have their letters seen when dropt, or carlessly mislaid; but I would not have it practised in knavish matters, to cheat those that are honest.

THE CHEMIST.

ACIDS.

NO. IV.

Citric Acid is obtained by the following process from lemon or lime juice. Boil the expressed juice for a few minutes, and when cold strain it through fine linen, then add powdered chalk as long as it produces effervescence; heat the mixture, and strain as before, a quantity of citrate of lime remains on the strainer, which, having been washed with cold water, is to be put into a mixture of sulphuric acid with 20 parts of water: the proportion of acid may be about equal to that of the chalk employed. In the course of twenty-four hours, the citrate of lime will have suffered decomposition, and sulphate of lime is formed, which is separated by filtration. The filtered liquor, by careful evaporation, furnishes chrystallized citric acid. The average proportion of citric acid afforded by a gallon of good lemon juice, is about eight ounces. Citric acid forms beautiful chrystals, of which the primary form is a right rhombic prism. They have a very sour taste, and are soluble in somewhat less than their own weight of water at 60°. It forms a class of salts called *citrates*.

Fluo-silicic Acid.—To obtain this compound, three-parts of fluor spar and two of glass or silica, finely powdered, are mixed in a retort, with about an equal weight of sulphuric acid. The gas evolved is to be collected over mercury, and when its production slackens, it may be accelerated by gentle heat. The mercury and glass vessels employed must be perfectly dry. Fluo-silicic acid, or silicated fluoric acid, as it is sometimes called, is a colourless gas; its odour is acid, much resembling hydrocilloric acid; its taste very sour. Its specific gravity 3.61 compared with air 100 cubic inches, weigh 110.138 grains. It extinguishes the flare of a taper; it produces white fumes when in contact with damp air, and when exposed to water is absorbed, and a soluble compound of silica and fluoric acid is formed, whilst a quantity of silica is at the same time precipitated. If the beak of the retort from which the gas is issuing, be plunged into a basin of water, it is soon

choaked by the copious deposit of hydrated silica which sometimes forms tubes through the water, by which the gas escapes directly into the air. When it is intended to saturate water with the gas, the effect above stated may be prevented, by agitation, or better by suffering the gas to escape through a stratum of mercury into water above it. Water thus saturated becomes a gelatenous mass, from which the acid liquor may be separated by placing it without pressure upon a linen filter. The liquor is sour, and when saturated with the fixed alkalies, becomes gelatenous but not turbid; with barylic salts it deposits a white precipitate; with bares it forms salts termed *Fluo-silicates.*

Fluo-boric Acid may be procured in a gaseous state, by heating it in a glass retort over a lamp, a mixture of one part of vitrified boracid acid, two parts of finely-powdered fluor spar, and twelve parts of sulphuric acid. It is most probable that in obtaining this gas, the oxygen of the boracic acid combines with the calcium of the fluor spar to form oxide of calcium or lime; and that the boron and fluorine unite to produce the gas. Fluoboric gas, according to Dr. Thompson, has a specific gravity 2.362, it is colourless, of a pungent odour, highly deleterious to respiration, and extinguishes flame. It strongly reddens litmus, and when bubbles of it are allowed to escape into the air, they produce a remarkable dense and white fume, in consequence of their eager attraction for and combination with aerial moisture. Water takes up 700 times its volume of the gas, increasing in volume and elasticity, forming a caustic and fuming solution, in which Berzelius found boracic and hydro-fluoric acids in combination; it would seem, therefore, that fluoboric gas decomposes water, and that the hydrogen of the water unites to the fluoric to form hydrofluoric acid, and the oxygen to the boron, to form boracic acid; when the solution is concentrated, the hydrofluoric and boracic acids again decompose each other, and the original compound is reproduced.

Formic Acid.—The peculiarities of an acid obtained by the distillation of *ants*, was first noticed by Fischer and Margraaf, but it was afterwards regarded as identical with acetic acid; Berzelius has shown, however, that it is a distinct compound; and Dobereiner has published some curious facts respecting its artificial formation. It may be obtained from a mixture of two parts of chrystallized tartaric acid, five of peroxide of manganese, five of sulphuric acid, and five of water. Soon after mixture, these ingredients, which should be in a sufficiently capacious vessel, effervesce violently, and give off abundance of carbonic acid, if afterwards distilled; the formic acid passes over: it possesses several peculiarities which amply distinguish it from acetic acid, among which the most remarkable is in the action of sulphuric acid, which converts it into water and carbonic oxide. The formic acid is converted into carbonic acid by the nitrates of silver and of mercury, those salts being at the same time converted to the metallic state. Its compounds are called formiates.

Gallic Acid may be obtained by the following process:—Digest bruised galls in boiling water, with about one-sixth their weight of vellum cuttings, for some hours, then allow the mixture to cool and filter it. Add to the filtered liquor a solution of acetate of lead as long as it occasions any precipitate from the whole upon a filter; wash the precipitate with warm water, and digest it in very dilute sulphuric acid; filter, and having saturated the clear liquor with chalk, evaporate it to dryness. Introduce the dry mass into a retort placed in a sand bath, and upon the application of heat, a portion of water will first rise, and afterwards a chrystalline sublimate of gallic acid, or boil an ounce of powdered galls in sixteen ounces of water down to eight, and strain. Dissolve two ounces of alum in water, precipitate the alumina by carbonate of potash, and after edalcorating it stir it into the decoction. The next day filter the mixture, wash the precipitate with warm water till it will no longer blacken sulphate of iron, mix the washing with the filtered liquor, evaporate, and the gallic acid will be obtained in circular chrystals. Gallic acid, when pure, is in whitish chrystals. They have a sour taste, and evolve a peculiar smell when heated. It dissolves in about twelve parts of water at 60 deg., and in rather more than two parts at 212 deg. It is soluble in alcohol and ether. It forms no precipitates in solutions of potash or soda, but when dropped into lime water, baryta water, or stentia water, it occasions the separation of a difficultly soluble gallate of those earths. With salts of iron, gallic acid produces a more or less intense violet-coloured discolouration, and ultimately a reddish brown precipitate. It forms salts called *gallates.*

Hydriodic Acid Gas may be obtained very pure by the following process:—Hydrophosphorous acid is to be evaporated until upon the point of evolving phosphuretted hydrogen gas. It is then

to be put with its weight of iodine into a small tube retort, the gas is liberated upon applying a gentle heat; 100 grains of acid and 100 of iodine afford 120 cubical inches. It is colourless, very sour, exhales fumes in the air, and smells like muriatic acid. It reddens vegetable blues. Its specific gravity to hydrogen is as 63 to 1. It is not permanent at a red heat, for when passed through a red-hot Porcelain tube it is partially resolved into iodine and hydrogen. It is rapidly and abundantly absorbed by water, but in what exact proportion has not been determined. The specific gravity of the strongest liquid acid is 1. to 7. It becomes dark coloured when kept in contact with the air, in consequence of a partial decomposition. It readily dissolves iodine. It is decomposed by the nitric and sulphuric acids. The liquid hydriodic acid is best prepared by passing sulphuriated hydrogen through a mixture of iodine and water; sulphur is deposited, and on heating and filtering the liquor a pure solution of hydriodic acid is obtained, which may be concentrated by evaporation at a temperature below 260 deg. Its compounds are termed *hydriodates*. J. MITCHELL.

CHEMICAL NOMENCLATURE EXPLAINED.

EVERY science has its peculiar technical or conventional terms; and it is not only desirable and advantageous, but absolutely necessary that their meanings should be properly and clearly defined and understood, if we wish to become thoroughly acquainted with the subject to which they relate. In our last number we gave an amusing extract from a little volume entitled " Chemistry no Mystery ;" we now extract the following from the same source, with the hope that it will not only prove interesting to our readers, but a recommendation to a work which we strongly recommend to the chemical novice:—

" We have hitherto regarded simple bodies as combining together and forming compounds; but we have taken no account of the combinations which occur between compounds themselves: of these there are a very large number, and the nature of some of them is not at all easy for a beginner to understand. Their composition was formerly much more difficult to remember than at the present time, because chemical substances were named after no fixed rule, but only according to the whim and caprice of their discoverers.

" Amongst the successful labours of modern chemists, the method of naming substances in a manner to indicate their composition, stands high in the scale of practical utility. You may already have formed some idea of its importance, although I have not directed your attention exclusively to the matter. The term chlorine indicates that the gas is greenish; hydrogen means the water-former, and oxygen the acid-former, because chemists imagined that every acid contained it. This opinion is incorrect, since *every* acid does *not* contain it; yet the greater number do, and therefore the term oxygen may still be retained with considerable propriety.

It is always taken for granted that an acid contains oxygen, except the contrary be expressed. By the term sulphuric acid, I understand an acid composed of sulphur and *oxygen*; by *hydro*-sulphuric acid, an acid composed of sulphur and *hydrogen*. When oxygen only forms two acids with a substance, then the name of the acid which contains the *smaller* proportion of oxygen is made to end in *ous*: and of the one which contains the *larger* proportion of oxygen in *ic*. If there should exist more than *two* combinations, then we are obliged to have recourse to *Greek* and *Latin words*. I may illustrate what I mean by referring to the compounds of sulphur and oxygen. Formerly only two such compounds were known; one composed of one atom sulphur and two atoms oxygen, and the other of one atom sulphur and three atoms oxygen; the former was called sulphur*ous*, and the latter sulphur*ic* acid. More recently there have been discovered two other compounds of oxygen and sulphur; one of which contains less oxygen than sulphur*ous* acid, and the other more oxygen than sulphurous, but less than sulphur*ic* acid; hence they are respectively called *hypo*-sulphur*ous* and *hypo*-sulphur*ic* acids; hypo, or upo, meaning under or less. In this diagram the two original compounds of sulphur and oxygen are represented by capitals; the two others by small Roman letters.

	Sulphur.	Oxygen.
Hypo-sulphurous acid	2	2
SULPHUROUS ACID ..	1	2
Hypo-sulphuric acid.......	2	5
SULPHURIC ACID	1	3

Now, before the introduction of this new nomenclature, sulphuric acid was known by the name of oil of vitriol; a name which gives us no useful information whatsoever, indeed it misleads us, for the so-called oil of vitriol is *no oil at all*.

If an acid whose name ends in *ic* com-

bine with a substance, the name of the compound is made to terminate in *ate;* for instance, sulphur*ic* acid with soda forms sulph*ate* of soda. If an acid whose name terminates in *ous* combine with a substance, then the name of the resulting compound is made to terminate in *ite;* for example, sulphur*ous* acid with soda forms sulph*ite* of soda. When a simple substance unites with oxygen, and does not form an acid, the compound is simply termed an oxide. In like manner the combination of iodine, chlorine, bromine, sulphur, and fluorine, with other simple substances, forms chlorides or chlorurets, iodides or iodurets, bromides or bromurets, sulphides or sulphurets, and fluorides or fluorurets. But the advantages of the new system of nomenclature are best displayed by some other examples which I now mean to give you.

"The chemist, Glauber, discovered a salt, which was long known by no other appellation than *Glauber's salt*; but this name conveys very little useful information indeed;—merely giving us to understand that Glauber was, in some manner or another, connected with it; a matter of very slight importance. Now Glauber's salt being a compound of sulphuric acid with soda, the framers of the new nomenclature called it sulph*ate* of soda, a term which immediately bespeaks its composition, and affords us a very useful piece of information. Again, there exists a substance commonly known by the name of sal-ammoniac; but what information does this convey? None at all: whereas the term hydrochlorate of ammonia, informs us that it is a compound of hydrochloric acid and ammonia."

ATMOSPHERIC GASES.

By experiments carefully conducted, it has been found, that the composition of the atmosphere is extremely uniform in all parts of the earth, and at all heights above its surface, and that it consists of

	By measure.	By weight.
Oxygen	21	23
Nitrogen	79	77
	100	100

Though these are the essential constituents of atmospheric air, it contains other bodies which are regarded as adventitious, and the quantity of which generally varies; of these, carbonic acid and aqueous vapour are the most important; the quantity of the former may be considered as amounting to about .01 per cent., so that upon the whole, the constituents of the atmosphere may be regarded as follows:—

	By measure.	By weight.
Nitrogen	77.5	77.55
Oxygen	21.	21.32
Aqueous vapour	1.42	1.03
Carbonic acid	0.08	0.10
	100	100

Nitrogen is a colourless gas, with neither taste nor smell, having no action upon vegetable colours nor lime-water; neither is it absorbed by water, unless that fluid has been deprived of its ordinary portion of air by boiling, when it takes up about one-and-a-half per cent. It is rather lighter than atmospheric air, compared with which, its specific gravity is 0.972. Its specific gravity, in reference to hydrogen, is as 14 to 1. An animal immersed in nitrogen is instantly suffocated, whence it was called by Lavoiser *azote* (from *a privative* and ζωη, *life*); but if that term be taken in its strictest sense, all gaseous bodies (excepting atmospheric air), might be included under it, for even oxygen itself will not indefinitely support life. The term nitrogen merely implying that it is a component of nitric acid; it is explicit and unobjectionable, therefore it is adopted in preference to azote. Nitrogen is a non-supporter of combustion. It may be obtained by mixing equal weights of sulphur and iron filings into a paste with water, and expose them to a confined portion of atmospheric air for forty-eight hours; the oxygen will be absorbed, and the nitrogen left nearly pure.

Oxygen may be obtained by mixing powdered oxide of manganese and sulphuric acid in such proportions, as to be about the consistence of cream. This mixture is to be put in a glass retort, and heated over an Argand lamp; the gas will pass over, and may be collected in the usual way with the pneumatic trough. It is insipid, colourless, and inodorous. Its specific gravity, compared with air, is as 1.111 to 1.000; compared with hydrogen, as 16 to 1. When powerfully compressed by the powerful depression of a piston in a glass tube, it becomes enormously luminous, a property which has not been observed in any gaseous body, except such as contain oxygen, and which property may be considered as one of its characteristics. It is absorbed in very small quantity only by lime-water. It does not alter the colour of litmus, nor does it render lime-water turbid. It is a powerful supporter of respiration. A small animal confined in oxygen, lives thrice as long as when con-

fined in the same quantity of common air; it has, therefore, been called *vital air*; but, as I before stated, it will not sustain life for any long period. A lighted taper when introduced into this gas, is very rapidly consumed, with intense ignition and enlargement of the flame. Sulphur, which burns in the air with a small blue flame, soon has its flame enlarged when immersed in a jar of oxygen, and burns with a beautiful colour. When phosphorus is burnt in oxygen, the light is so intense, that the eye can scarcely bear its brilliancy. Oxygen is more abundantly diffused throughout nature than any of the other elementary bodies. An account of carbonic acid will appear in one of my next papers on acids.

J. MITCHELL.

MISCELLANEA.

The Sting of Bees.—Although the poison which a bee emits, when it inserts its sting, is proved to be a highly concentrated acid, it does not follow that the application of all alkalies will neutralize the acid. Ammonia, for example, we have known in several instances, to produce distressing consequences—such as excessive local inflammation, temporary erysipelas, and general distress to the constitution. The more gentle alkalies—chalk or the "blue bag," are much more likely to effect a cure, and cannot injure. The same person will be variously affected by the sting of a bee; at one time scarcely any inconvenience will attend it; at another much swelling: again, but little enlargement, although great pain, &c. The eye suffers considerably, though in general the uneasiness is local; but if the back of the ear be stung, there is frequently a general affection of the system, sickness, giddiness, numbness, nervous trembling, &c., which will sometimes continue for hours. A draught of camphor julep, and total repose, we have known to be beneficial in this latter case, and would earnestly recommend it to our readers, should they be placed in circumstances to require assistance.

Drawing an Inference.—The proprietor of an immense number of water-side carts in Liverpool, who has raised himself by industry to be a man of considerable property, being in close conversation with a gentleman about some private business, was asked by the gentleman if he could draw an inference. "Not I," said he, "but I bought a mare the other day, and I'll lay a five-pound note that she draws it, if it does not weigh more than five tons."—*Noble's Compendium.*

Loch Leven.—The origin of the name Loch Leven is somewhat curious. It arises from the circumstance of the number eleven frequently occurring in matters connected with the lake. As already mentioned, it is eleven miles in circumference; the lands of eleven lairds at one time embraced its waters; there are eleven rivers and streams running into it; it contains eleven kinds of fish; and in the adjoining plantations are eleven kinds of wood. The name was, therefore, originally, Loch Eleven; but in the course of time the E was omitted as at present.—*Walks and Wanderings in the World of Literature, by the Author of "The Great Metropolis."*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 23, Rev. R. Vaughan, D.D., on the History and Antiquities of Athens. Friday, Oct. 25, S. C. Horry, Esq,, Barrister, on Petit Juries, their Origin, Rights, Duties, and Influence. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 24, John Frederick Goddard, Esq., Lecturer on Optics at the Royal Gallery of Practical Science, on the Oxyhydrogen Microscope, with illustrations. At half-past eight.

QUERIES.

What will be the thickness of metal required for a concave copper ball, eight inches diameter without, so as to sink to its centre in common water? A. D. M.

How to procure India-rubber thread, such as is used for braces, lapped with cotton twist.
A CONSTANT READER.
Blackburn.

How to make crumpets, muffins, gingerbread, biscuits, and buns? A. A.

The preparation to be applied to a stucco wall before papering, and likewise the ingredients used in making paper-hangers paste?
A SUBSCRIBER.

How is steel to be gilt in the cheapest way, as steel pens? What kind of varnish is used for Dutch metal on paper or on wood, for preventing tarnishing? Is it oil or spirits of wine?
A CONSTANT READER.

The power, weight, and dimensions of Hancock's steam gig or phæton? J. MITCHELL.

If J. Mitchell can inform me how to obtain a *pre*sulphate of iron, he will much oblige a
JUVENILE ENTERTAINER.

ANSWERS TO QUERIES.

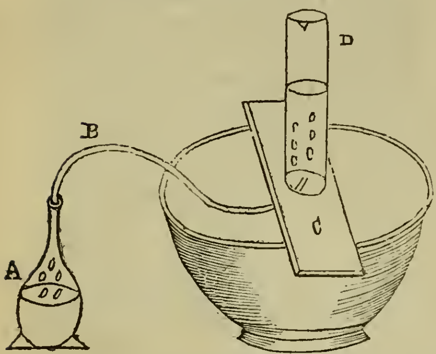
To make Green Fire.—Seventy-seven parts of nitrate of baryta, thirteen parts of flowers of sulphur, five of chlorate of potassia, and a small quantity of charcoal.

To make Carbonic Acid Gas.—"A Subscriber," will find the process described in one of my papers on the acids in Nos. 1 & 2 of the fifth volume. J. MITCHELL.

To make Frankfort Black.—"F. J. F." This is made by calcining vine branches and other refuse lees of the vinegar vats of Germany; they must be previously washed.
JUVENILE ENTERTAINER.

To procure Hydrogen.—Pour diluted sulphuric acid, or spirits of vitriol, as it is generally called, upon iron or zinc filings, or turning in a Florence flask, adapted with a good cork, and a piece of bent tubing. It can then be collected with the pneumatic trough. I have used a very good and cheap substitute for the pneumatic trough, which will perhaps be useful to some of your readers:—A, the flask, containing the diluted acid and filings; B, the bent tube; C, the shelf; D, the receiving vessel, and E, the basin, answering the purpose of a pneumatic trough.

J. MITCHELL.



Paper may be stained scarlet by sponging it over with a weak solution of nitro-muriate of tin, and then again with a strong infusion of cochineal (in the proportion of about a quarter of an ounce of the powdered cochineal to eight ounces of boiling water, letting it infuse for one hour, then strain it). The paper is then glazed, by submitting it to a powerful pressure.

To make Fluoric Acid.—"Jones." Fluoric acid is procured from a substance well known in mining districts called fluor spar. It is found chrystallized in cubes of various colours, green, yellow, and purple. If this mineral be reduced to powder, mixed with twice its weight of strong sulphuric acid (oil of vitriol), and subjected to distillation, a powerful and highly corrosive liquid may be obtained. For this purpose, a leaden or silver retort and receiver must be employed; and while a moderate heat is applied to the retort, the receiver must be kept cool by pounded ice or snow. The acid thus formed must be preserved in silver or leaden bottles, with stoppers of the same materials. It is extremely volatile, and not easily confined. It is necessary to use great caution when experimenting with this substance, as its vapours are highly irritating, and when applied to the skin, it disorganizes it so rapidly, as to occasion dangerous ulcers. It acts strongly on glass, and corrodes it deeply.

To make an Infusion of Gentian.—"F. J. F." Take of gentian root bruised, two drachms; dried orange peel, two drachms; and fresh lemon peel, four drachms; pour upon these ingredients one pint of boiling water; let them infuse for one hour. The above is the same as ordered in the London Pharmacopœia.

To make Red Fire.—"G. R. C." Forty parts of dry nitrate of strontia, thirteen of powdered sulphur, five of chlorate of potassa, four of sulphuret of antimony, and a very small quantity of charcoal. The chlorate and sulphuret should be separately powdered and mixed together on paper with the other ingredients.

Plaster Figures may be Varnished after being done over two or three times with size, so that they will bear washing

To Polish Shells.—This may be done either by hand labour, or by being varnished; in both cases all the rough parts must be well rubbed down with emery and water. If they are to be polished by hand (which is the best and most lasting way), after they have received two and three courses of emery of different degrees of fineness, they must be finished with buff leather dressed with rotten-stone and oil.

TO CORRESPONDENTS.

Juvenile Entertainer.—*His apparatus for remaining under water, a drawing and description of which we have received, we consider as not only ingenious, but likely to become of great utility, especially in the cases he mentions; if it be his intention to divulge his invention, we shall feel pleasure in recording it in the "Mechanic;" but some expressions in his letter have caused a doubt whether he intended it as a private communication, or for insertion—we await his answer.*

A. B., *the inventor of an apparatus for stopping horses, is requested to send us his address, a gentleman having written to us expressing a wish to see the invention.*

S. Rowbotham, *Worcester, will receive a communication per post.*

Tyro Chemicus *will find a letter addressed to him at our office. Letters are also left for our correspondents*—Electron, J. Mitchell, Alpha, and C. H.

Numerous queries and other communications, for which we have not sufficient space this week, are nevertheless intended for insertion.

A SPLENDID RAILWAY MAP!

With the MECHANIC AND CHEMIST of October 26th, will be presented (gratis) a

SPLENDID MAP OF ENGLAND AND WALES; showing, in addition to all the Principal Towns, the routes of the Railways through the various Counties; forming a handsome Frontispiece to Vol. IV. To ensure early impressions, give immediate orders to your Booksellers or Newsmen.

London: G. Berger, Holywell-street, Strand; and all Booksellers in Town and Country.

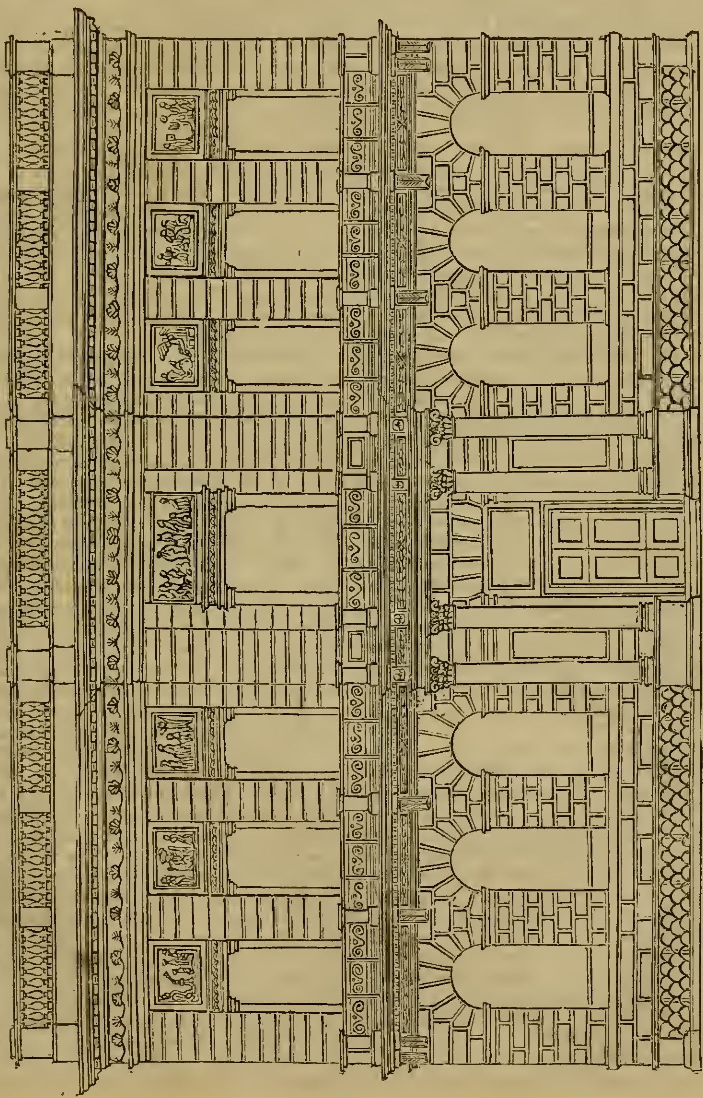
London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 57 & 58, NEW SERIES. | SATURDAY, OCT. 26, 1839. PRICE TWO-PENCE. | Nos. 178 & 179, OLD SERIES.



FRONT ELEVATION OF THE OXFORD AND CAMBRIDGE UNIVERSITY CLUB HOUSE.

 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney

HISTORY OF ARCHITECTURE.

NO. VIII.

(Concluded from page 362.)

(See engraving, front page.)

We have now briefly glanced at the progress of architecture in England up to the time of Sir Christopher Wren, many of whose works are extant. As a finale, we will give an example of the architecture of the present day by *living* architects. The one selected for this purpose is the *Oxford and Cambridge University Club House*, for the elevation of which, and the following particulars, the writer is indebted to the "Civil Engineers' and Architects' Journal."

"The front extends 87 feet in width, its height being 57 feet from the ground line to the top. An entablature, marking the separation of the ground story from the principal floor, and projecting forward in the centre of the building over four Corinthian columns, divides the front, horizontally, into two equal parts. The centre space on the ground floor is occupied by the portico which projects to the front line of the area; the centre intercolumnation is wider than the rest, forming the entrance to the hall; the four columns stand upon pedestals four feet high, with mouldings and cornice. The upper part of the building is terminated with a delicate Corinthian entablature and balustrade, proportioned to the whole height, breaking forward with the centre of the building, which corresponds in width with the portico on the ground-floor; thus the front is divided vertically into three main compartments, the centre being less in width than the other two, which assume the appearance of wings; the effect of a centre, indicated by the projecting portico on the ground-floor being thus maintained throughout the whole height of the building.

"The angles of the centre division, on the principal story, are formed of rusticated pilasters; the principal window occupies the space between these pilasters, which having neither bases nor capitals, produce a uniformity in the lines round the windows, giving it the appearance of being contained in a frame. This window, designed with *antæ*, in lieu of architecture, supporting an enriched entablature, is much wider than the rest, and standing clear of the pilasters, with its mouldings to profile, forms in itself a feature in the design. Rusticated pilasters, similar to those already described, divide each wing on the principal floor into three equal, recessed, oblong spaces, containing the windows, similar in design to the one already described, except that the mouldings to the *antæ* and entablature do not profile, but stop against the inner side of the pilasters. The ground story is rusticated, and the windows have semicircular heads, with radiating rustics, and impost mouldings. A balcony, projecting three feet, continues throughout the whole line of front, and breaks forward with the portico, the parapet being formed of pedestals, with intervening panels of richly-designed foliage, cast in metal in high relief, and the landing supported by elaborately enriched consoles. The frieze of the entablature over the ground story, is filled with convex panels, enriched with laurel leaves, and over each column of the portico are shields bearing the arms of the Universities. The whole of the ornamental detail throughout is designed to correspond in richness of effect with the Corinthian capitals of the columns, which have their central volutes entwined. Below the ground story there are two stories, a *mezzanine* and basement, which are screened by the area parapet.

"The bas-reliefs in the panels above the windows of the principal floor require particular notice; they are executed in Roman cement by Mr. W. G. Nicholl, from designs by R. Smirke, Esq., R. A., and illustrate those exalted labours of the mind which it is the peculiar province of the Universities to foster and promote. They recall to mind the sovereignty of Greece and Italy in the divine art of poetry, and the full measure of intellectuality vouchsafed to the inhabitants of this our portion of the globe. In the centre panel Minerva and Apollo preside on Mount Parnassus, a female figure personifying the river Helicon, forms part of the group, and pours from an urn the source sacred to the God of verse; the Muses surround them at the foot of the Mount. In one of the extreme panels, allusion is made to the popularity of the Iliad, in which Homer is represented singing to a warrior, a female, and a youth; in the other, Virgil is represented singing his Georgics to a group of peasants. The remaining four panels represent, first, Milton reciting his verses to his daughter, inspired by a superior agency seen hovering over him; Shakespeare attended by Tragedy and Comedy; Newton explaining his system; and Bacon recommending his philosophy to his auditors."

This building is situated on the south side of Pall-mall, near St. James's Palace, and Sir Robert Smirke, R. A., F. R. S., and Sydney Smirke, Esq., are the architects.

In this series of papers, of which the present is the last, the primary condition, viz., that of viewing the "History of Architecture" in *religious* edifices, has been in general adhered to; though, in some instances, it was necessary to deviate from the course suggested. We first attempted to consider the massive, but grand and imposing Egyptian style; next, the elegant and ornate Greek; then the bold Roman, and, lastly, we have less briefly reviewed the progress of architecture in England. In conclusion, permit us to hope that these articles have been found interesting and instructive, if so, the object of the writer is attained.

PROPORTIO.

TRANSFERRING PRINTS TO THE SURFACE OF WOOD, AND EITHER REVERSING THEM OR NOT;

AND ON MAKING AND APPLYING HARD WHITE SPIRIT VARNISH.

(From Journ. de la Societe du Bas. Rhin.)

THIS poocess is very analagous to that formerly employed in transferring prints to the surface of glass, and to the back of which prints coloured were afterwards applied, so as in some degree to imitate oil pictures. Here, however, they are applied upon the surface of wood, such as cornel, sycamore, horse chesnut, satin wood, *aer wood*, or the curly-veined maple, &c., which is afterwards to be varnished.

The wood having been planed smooth and even, is to have a slight coat of the best glue applied upon it; when this has become dry, it must be rubbed with Dutch rushes, or glass paper, to remove the small filaments which the glue has raised, and render the surface uniform. We then apply a layer of white alcoholic varnish, taking care not to cross the marks left by the brush, and pass as few times as possible over the same place; it is then left to dry. We afterwards apply in succession, three, four, five, or six, other coats of varnish upon it, according as the varnish may be thinner or thicker.

The edges of the print are then to be cut close to the engraving; and it must be laid upon a proper table with the impression downwards; it must be then uniformly moistened with a wet sponge, or in any other manner. When it has been equally and thoroughly wetted, it must be placed between two leaves of blotting paper, in order to remove any drops of water. We then apply another coat of varnish over the surface of the wood; and before it is become dry, apply the moistened print upon it with the engraving downwards. In order to do this, we lay one edge of the print first upon the surface of the wood, holding it suspended by the other hand, and wipe successively over the back of the print in such a manner as to drive out all the air and prevent the formation of blisters. We then lay a sheet of dry paper upon it, and pass a linen cloth over every part of the print, in order to fix it securely upon the varnish. We must take great care to place the print steadily upon the varnished wood, lest we may make a false or distorted impression of it. We then leave it to dry; and when it has become thoroughly dry, we moisten the back of the paper with a sponge, and pass or lightly rub the fingers backwards and forwards over it repeatedly, so as to remove the moistened paper in small rolls curled up. When, however, the marks of the picture begin to appear, we must take care, lest in rubbing we should remove any portion of the paper upon which the impression is taken. When we find, therefore, that we can remove no more of the paper without incurring the risk of injuring the print, we suffer it to dry; in drying, the engraving will entirely disappear at the back of the print, it remaining covered with a slight film of paper. But, on again giving one coat of varnish, it will be rendered entirely transparent. It must then be again suffered to become quite dry. If by chance we have raised any small parts of the engraving, we must retouch those defects with fine lamp-black and gum water, before we proceed to varnish, as we have before mentioned; great care must be used in laying on a second coat of varnish, passing rapidly over the retouched parts. When this last coat of varnish is become perfectly dry, we may remove any projecting part of the paper, and polish it with Dutch rushes, steeped for three or four days in olive oil; we then remove the oil by rubbing with a fine linen cloth, and sprinkle it all over with starch or hair powder; this will absorb the least remains of the oil, and we remove it by first passing the palm of the hand over it, and then by carefnlly wiping or rubbing it with a fine linen cloth; we next apply three or four more layers of varnish, taking care to let it dry between each coat. When the last coat is become quite dry (in three or four days' time), we polish the varnish with a piece of fine woollen cloth, and chalk or whiting of the finest kind.

In order to prepare this fine chalk, we must grind the ordinary chalk in a mortar with a little water; and when it is well

ground, we add more water, and pour it into a glass vessel, suffering it to remain at rest for five or six minutes, it will then have deposited its coarser particles. We then decant the liquid, which holds in suspension the finer particles of the chalk; let it rest, and when the water has become clear we pour it off, and shall find the sediment in the form of a paste, and which we use to polish the varnish with. We must take care to use it in the moist or wet state; as, if it becomes dry, it is impossible to preserve it in the minutely divided state, and we should run the risk of polishing the varnish in streaks. If, however, we would have the varnish still more shining, we must wash off all the remains of this fine chalk with water, and polish it with the palm of the hand only slightly moistened. But to have it still more brilliant, after having washed away all the chalk and suffered it to become quite dry, we must pass all over it a thin coat of varnish, either in the sunshine, or near a warm stove, in order that the varnish may be extended uniformly upon the surface.

White Spirit of Wine Varnish.

Rectified spirit of wine......	24 oz.
Fine sanderach	4
Fine turpentine	1
Spirit or oil of turpentine......	1
Camphor....................	2 gros.

We must select the most transparent sandarach, and that which is the least yellow; but if it be not of the best possible kind, we must wash it in a weak lie of potash, and then in a large quantity of water, and let it dry perfectly. For the quantity above directed, we must take a bottle of white glass well dried, and of the capacity of forty ounces; and after pulverizing the sandarach, we reduce the particles of it to a kind of thin paste, by triturating it with some of the spirit of wine, and put it by degrees into the bottle. We likewise mix the turpentine and the oil of turpentine together, by rubbing them up in the same mortar; and when the turpentine becomes more liquid, we may increase its liquidity by adding some spirit of wine to it, and pour it into the bottle, when we must shake it for some time, in order to mix the materials well together. We likewise put the camphor into the mortar, and beat it up with some drops of spirit of wine; we then add a larger quantity of the spirit, which will entirely dissolve it; this is then to be poured into the bottle, and it must be again well shaken for some time, in order thoroughly to mix all the materials together. The bottle must then either be exposed to the heat of the sun or that of a warm stove, for ten or twelve days, taking care to shake it from time to time, and to unstop it, in order to suffer the vapour to escape; but finally it must be close stopped, and the varnish kept for use.

On applying the Varnish to Wood.—We place the subjects which we would varnish, either in the sunshine or near a warm stove. We then apply six, eight, or ten coats of varnish. We must take care never to apply a second coat until the former one has become quite dry. If we could give the piece of work a fine lustre, we may polish the varnish after the last coat is become quite dry, with finely-washed chalk, applied whilst wet upon a soft woollen cloth; or we moisten the palm of the hand and rub the varnish with it, until it has acquired a perfect polish. Before applying the varnish upon wood, however, we must always prepare it by a coat of glue.

On fixing Prints upon Wood, in their natural position, and removing the Paper from them.—We select a surface of any kind of wood, the size of the print; we then moisten a piece of thick drawing paper, of a proper size, and apply upon its surface a layer of thin glue; we then suffer it to dry, and give it two or three more coats of the same glue, letting it dry between each coat; we then prepare the surface of this paper, to receive the print, in the same manner as the wood was prepared, as described in the first part of this article, by coating it with several layers of spirit varnish. We then apply the print, and conduct the operation exactly as before, to the period when we remove the last portions of oil by means of starch, and give several layers of varnish. The wood being then prepared to receive the print by the coat of glue, and several layers of varnish applied in the manner before described, we fix upon it the leaf of drawing paper, bearing the print upon its prepared surface. We then apply a coat of varnish to the wood, and affix the prepared paper, and print upon it whilst it is still moist; and so as to prevent the forming of any blisters of air blubbles between them. When we think that the varnish is become hard, with the help of warm water and a sponge, we moisten the glued paper which covers the whole; we then remove that paper, which readily comes off; and with the aid of warm water and the sponge we cause the glue to disappear from the varnished surface of the print; we then polish it with prepared chalk, and finish it, as before

INDEX.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

VOL. IV.—1839.

WITH NUMEROUS ILLUSTRATIONS.

LONDON:

G. BERGER, HOLYWELL-STREET, STRAND;

AND MAY BE HAD OF ALL BOOKSELLERS.

CITY PRESS, 1, LONG LANE:
D. A. DOUDNEY.

PREFACE.

The conclusion of the Fourth Volume of "The Mechanic and Chemist," and the First Volume of the New Series, affords us another opportunity of thanking our numerous contributors, subscribers, and the public, for the very distinguished patronage with which they have been pleased to honour this work.

It has ever been, and will continue to be, our grand object, to promote the diffusion of useful knowledge, by combining it with rational and agreeable amusement, and rendering it almost universally accessible, by producing it in the most economical form.

The people of this country have but one alternative; they must renounce the benefits of instruction, or they must instruct themselves; for notwithstanding the numerous and richly-endowed schools, of which England may justly be proud, the education of the great mass of the people is unprovided for by any public institution. Some are diverted from the original and benevolent intentions of their founders, by a succession of mercenary and unfaithful guardians; others are too limited in their resources to be able to dispense any extensive instruction; and the late discussions in Parliament show how little assistance may be expected from that quarter. But the great work of instruction is going rapidly on; mechanics' institutions, and other useful associations,—the offspring of popular intelligence and desire for knowledge,—are increasing both in number and importance throughout the country, while the press is teeming with cheap publications, adapted to almost every want, and to every taste. Unfortunately, however, all those wants are not legitimate, nor are all tastes equally refined; but it is gratifying to observe that public favour is most liberally bestowed upon those works which, like well-weeded gardens, are preserved from all that is pernicious or useless. This negative

merit may, without presumption, be claimed by the "MECHANIC AND CHEMIST;" and, with the aid of our numerous correspondents, we have made it, not only a register for recording and giving publicity to useful inventions, and a medium of communication between mechanics and others, but a compendium of scientific information of permanent interest.

The present Volume contains much matter for the serious consideration of the engineer, the philosopher, and, most especially, for the inventive genius; it is enriched with numerous and valuable original papers, imparting accurate instruction to the novice, and enlivened by miscellaneous articles for the entertainment of the general reader.

The period embraced in the publication of this Volume, has been prolific in mechanical and scientific inventions. The magnificent discovery of M. Daguerre, is developed in a succession of articles with great minuteness, and, perhaps, with greater accuracy than can be found in any contemporary publication in this country. In conclusion, we repeat the expression of our thanks for the flattering reception we have met with; and our gratitude shall be shown by renewed exertions to render the "MECHANIC AND CHEMIST" worthy of the age, and of the nation in which it circulates.

END OF VOL. IV.

stated. This process may also be employed, not only to apply prints upon the surface of wood, but also upon metals, &c.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 45.)

Stoney Stratford, a market town in Buckinghamshire, is situated on the Roman paved way called Watling-street, from which the name of Stoney was probably derived. It contains a church dedicated to St. Giles, and the ruins of another, which was nearly destroyed by fire in 1742. There are meeting-houses for dissenters of several denominations, numerous charity schools, and a society for apprenticing children. The centre of the town was formerly adorned with one of those beautiful crosses which were erected upon the spots where the remains of Queen Eleanor rested; but it was destroyed, with many other valuable monuments, by the barbarous zeal of the snuffling hypocrites of the revolution.

Fenny Stratford is also situated on the Watling-street; it is a small market town of little tiade, surrounded by land which was formerly a fen, but now completely drained, and its waters carried off by the Grand Junction Canal. The chapel was rebuilt in 1724, by the exertions of Mr. Browne Willis, an antiquary, who dedicated it to St. Martin, and laid the first stone on St. Martin's day; the saint is indebted for this compliment to the circumstance of Mr. Willis's grandfather dying on St. Martin's day, in St. Martin's lane. The Swan Inn is said to have borne that name ever since the year 1474; another inn, now of little note, the Black Bull, was anciently the abode of a fraternity of monks. This dull town, like most others on the line, has suffered much loss by the traffic being transferred to the Railway.

Buckingham, the county town of Buckinghamshire, is a borough and market town, 55½ miles from London, and ten miles west of the Railway. It is a place of very great antiquity. It is supposed by some to derive its name from *Bec*, a beech, with which description of tree the county formerly abounded; others assert that it was adopted from the deer which were found in great nnmbers in the woods of this part of the country; others, finding that the name was originally written *Bockingham*, trace its derivation to the Saxon *Borking*, a chartered land, and *ham*, which in Saxon signifies a home. It has been the scene of some important historical events; it was here that the Roman general, Aulus Plautius surprised and defeated the Britons under the command of the great Caractacus, and a kinglet called Togodumnus. In 918, Edward the Elder resided here for some time, and erected two forts to defend it from the Danes, who nevertheless took the place and ravaged it in 941, and again in 1010. At the time of the Norman Conquest, it was the only borough in the county; and so inconsiderable a place, as only to be taxed for one hide. In the reign of Edward III. its importance was increased by that prince making it a market for wool; but that trade being afterwards removed to Calais, it again declined. In the 27th year of Henry VIII., it was enumerated amongst the decayed cities and towns, for whose relief an Act of Parliament was then passed, and the assizes, previously held here, were removed to Aylesbury, through the interest of John Baldwin. In 1724, Buckingham suffered severely from a dreadful fire, which entirely consumed 138 houses, being above one-third of the whole town. The damage was estimated at 40,000*l.* Since this accident, its trade has partially revived, and part of the county business has been restored through the influence of Lord Cobham. The church is the most conspicuous monument in Buckingham; it was commenced in 1777, and completed in four years, at an expense of 9,000*l.* of which 7,000l. was contributed by Earl Temple. It is a spacious and handsome structure, with an ornamented square tower, and an elegant spire, which rises to the height of 150 feet from the ground. The interior is constructed on the same plan as Portland Chapel in London. No interments are permitted in the church or in the ground adjacent to it, nor are funeral ceremonies allowed to be performed; but about two hundred yards south-west of the church, there is a burial ground, and a small chapel for the accommodation of the clergyman at funerals. The area surrounding the church is laid out in a pleasant walk, planted with trees. A view is obtained from this spot of the serpentine course of the river Ouse, which winds round three sides of the town. Buckingham contains some excellent charitable institutions, and various accommodation for divers religious sects. It has given the title of Duke to several families. The present Duke is said to have obtained the title through the intercession of Louis XVIII. with the Regent, afterwards George IV. Previous

to the departure of the French King from this country, the Marquis of Buckingham gave up his mansion, Hartwell House, near Aylesbury, for the occupation of the exiled King.

COLOURED FIRES.

A LITTLE work, entitled "the School Boy's Holiday Companion" was advertized a month or two back, on the covers of "the Mechanic;" it is not yet published, but will be ready in a few days. The author has allowed us to present our readers with the following extracts, which will answer the queries that have been addressed to us from several correspondents, and be particularly acceptable at the approaching season, which for ages past, has been devoted to the exhibition of fireworks.

The following will be found among its pages:

White Fire.—1 Lamp black, 2 red arsenic, 7 sulphur, 24 nitre.

Blue Fire.—1 Lamp black, 1 sulphuret of antimony, 2 sulphur, 6 nitre.

Green Fire.—1 Lamp black, 3 chlorate of potash, 8 sulphur, 42 nitrate of barytes.

Purp'e Fire.—1 Lamp black, 2 red arsenic, 7 sulphur, 24 nitre, 24 nitrate of strontian.

Crimson Fire.—2 Lamp black, 4 sulphuret of antimony, 5 chlorate of potash, 13 sulphur, 40 nitrate of strontian.

Several others are given, with directions for using them; but these may suffice for the present. A good way is to pour them into a red-hot ladle.

In the plate is a pneumatic trough, very similar to the one described by your able correspondent, Mr. Mitchell. The board, instead of lying on the basin, is cut smaller, so as to sink an inch into it, and is kept down by two pieces of lead fastened to the under side.

MISCELLANEA.

Steam Travelling on Common Roads.—We have the satisfaction of announcing to the public, that Mr. Hancock's steam carriage, the *Automaton*, accomplished its first trip from London to Cambridge on Monday last. The carriage left the Four Swans, Bishopsgate-street, at ten o'clock in the morning. The time in actually running the 52 miles was four hours and a half.—*Cambridge Free Press.*

Antiquity of Railways and Gas.—Railways were used in Northumberland in 1633, and Lord Keeper North mentions them in 1671 in his journey to that country. A Mr. Spedding, coal agent to Lord Lonsdale, at Whitehaven, in 1765, had the gas from his Lordship's coal-pits conveyd by pipes into his office for the purpose of lighting it; and proposed to the magistrates of Whitehaven to convey the gas by pipes through the streets to light the town, which they refused. —*Worcester Guardian.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Oct. 30, Rev. R. Vaughan, D.D., on the History and Antiquities of Athens. Friday, Nov. 1, S. C. Horry, Esq,, Barrister, on Petit Juries, their Origin, Rights, Duties, and Influence. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Oct. 31, W. Maugham, Esq., A. Inst., C. E., Lecturer on Chemistry at the Royal Gallery of Practical Science, on Lime, Baryta, and Strontia, and their use in the Arts. At half-past eight.

TO CORRESPONDENTS.

J. Mitchell's *suggestion shall be taken into consideration.*

Juvenile Entertainer.—*His apparatus for enabling divers to remain under water without communication with the atmosphere above, will appear as soon as the engraving is ready.*

J. T. *will receive all the information we can obtain, next week.*

W. H.—*An article will shortly appear on the subject of his enquiry.*

J. W. *will also find his queries answered in the same article.*

A Correspondent *is informed that he may see a small steam boiler nine inches and a half long and five inches and a half in diameter, with feed-cock, safety-valve, pipe, and stop-cock, at No. 3, Norman-buildings, Haggerstone Bridge Kingsland-road.*

D. J.—*A periodical work devoted exclusively to instruction in the elements of mathematics, would not, we fear, create that continuity of interest which is necessary to the success of such an undertaking; notwithstanding the many works now published upon those subjects, it is possible to render many branches much simpler and easier to be understood, than in the form in which they are usually exhibited; but a work of this description must be executed by one thoroughly versed in mathematical science, though he only undertakes to explain the leading principles.*

H. S.—C. M. X., *and* B. O., *in our next.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

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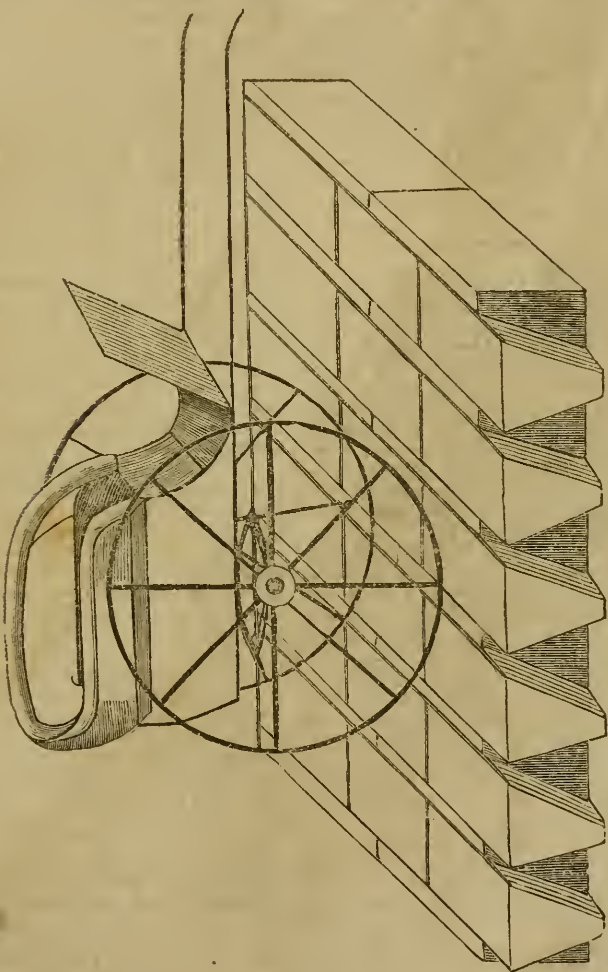
No. 59, NEW SERIES. SATURDAY, OCT. 26, 1839. PRICE ONE PENNY. No. 180, OLD SERIES.

SCOTT'S IMPROVED WOOD PAVEMENT.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney

WOOD PAVING.

To the Editor of the Mechanic and Chemist.

(See Engraving, front page.)

SIR,—I take the liberty of sending you a drawing of some wooden block paving, which I have been led to consider the subject of, by observing the manner in which a great part of that I have seen laid down sinking so much, as to be not only unsightly, but making a very indifferent road for travelling, and which it must always do, should its foundation be less solid in one part than another, on account of their form. In the one I propose, it be perceived, that the form of the blocks, and being put together in the manner shown in the drawing, prevent the possibility of such an occurrence; as the greater the pressure the greater the strength and solidity. Should you think this worthy of insertion, you will oblige by so doing.

I remain yours, &c.

W. SCOTT.

Walworth.

THE ECCALEOBION.

THAT eggs should be hatched by exposure to a proper temperature, artificially produced, is a circumstance which adds but little to the wonders exhibited by the incomprehensible process of nature; it is well known that the ostrich deposits its eggs in the sand, where life is developed by warmth which does not proceed from the parent; and in Egypt, artificial incubation is practised to a surprising extent. Mr. Bucknell, in his treatise on the eccaleobion, &c., says,

"The Egyptians imitate the ostrich; they arrange eggs in *mammals*, or ovens, built in such a manner as to give to the eggs the necessary protection from the slight atmospheric changes of their almost unvarying climate; and a small fire, running lengthways through the different compartments, maintained for the first eight or ten days, is sufficient to promote incubation; the loss of heat from radiation during the remaining days of the process, owing to the genial nature of the clime, being so trifling as not to destroy the vitality of the egg.

"Under circumstances so peculiarly favourable, it is nevertheless a task of no ordinary difficulty, and which, requiring the most minute care and attention on the part of the operator, is practised only by a few individuals; these inhabit a particular village, named Bermé, situated in the Delta of the Nile, about sixty miles from Grand Cairo, and by teaching the secret to their children, these Bermeans perpetuate the practice of their art. It is, however, only during the serene autumnal months, that they will venture upon the performance of this curious business, at which time, scattering themselves over the whole land of Egypt, they bring into existence, under the supervision of the government, the enormous and almost incredible number of above ninety-two millions of various kinds of poultry. The ovens being limited to three hundred and eighty-six, and the business monopolized by the government, we may conclude this estimate a near approximation to the truth."

This process, with such additions as were suggested by the less genial climate of Europe, has been tried at different periods, and in different countries, with partial success; but no result has been obtained, so satisfactory as to lead to its general adoption as a means of increasing the production of poultry for useful purposes, until the eccaleobion was invented by Mr. Bucknell. This apparatus is thus described by the inventor:—

"The eccaleobion, or life-giving machine, forms, to outward appearance, an oblong, square, wooden box, about nine feet in length, three feet in breadth, and three feet and a half in height, covered, excepting the doors, with cloth. It stands upon a table, and is entirely disconnected from the walls against which it is placed. Its efficient action and regulative power are inclosed within.

It is divided into eight compartments, or divisions, open to the sight (the doors being glazed) in which the eggs are deposited, spread promiscuously upon the floor of each division. The eggs lie uncovered, neither wrapped in flannel, nor immersed in sand, as has usually been done, in order that they might retain their warmth when exposed to cold, or resist the effects of too great heat.

"The eccaleobion is capable of containing upwards of two thousand eggs;—each egg has the power of generating heat, as the bird within it advances to maturity; consequently, a very successful issue, from a large number of eggs, can be expected only when such quantity is subjected to an uniform action of the machine, regulated according to the degree of heat engendered by the birds. Or, in other words, the degree of temperature suited and administered to a thousand eggs, during the last week of incubation, would not elicit life in a thousand fresh eggs, submitted to the same influence; while the temperature, necessary to produce life in the latter, would destroy it in the former.

In consequence of this physical law, a great sacrifice of life is incurred in the endeavour to bring a large number of birds daily into existence; nevertheless, by using certain counteracting measures while eggs can be obtained plentifully and good, the average will exceed one hundred daily —or, about 40,000 per annum."

The time of incubation varies with different birds; the swan requires 42 days, and is said to live 200 years; the goose 30 days, and lives 80 years; the hen 21 days, and lives 18 years; the canary 14 days, and lives 14 years. The eggs of different birds do not all possess the same nutritive property; it is observed by a French writer, that if we harden in boiling water the eggs of young hens, in which the yolk is usually a pale yellow; those of a guinea hen, which have the yolk of a saffron colour; and some ducks' eggs, in which the yolk is a deep red-yellow: and if we afterwards take equal weights of each of these yolks, and extract the oil from them in the usual manner, we shall obtain more oil from the yolks of the guinea hen, than from those cf the pullet, and most of all from those of the duck: from which experiment it may be concluded, that the yolk owes its colour in a great measure to the oil it contains.

The albuminous cords which connect the yolk with the white, have been variously designated by vulgar error; but they are not the source of vitality, as commonly supposed, and are found in unimpregnated eggs as perfectly developed as in those which are impregnated. They are not generally of the same magnitude, that extending towards the great end of the egg being larger than the other which lies next the small end of the egg. Sometimes one of these cords is wanting; but this happens more frequently in the eggs of guinea fowl, than in those of the common hen.

The process of incubation is beautifully displayed upon the table of Mr. Bucknell's exhibition room, from the first spark of visible life, to the formation of the perfect chicken. We extract the following description from Mr. Bucknell's treatise:—

"The following progressive series of phenomena are daily observable during the process of incubation, in the egg of the common fowl:—

"In an impregnated egg, previous to the commencement of incubation, a small spot is discernible upon the yolk, composed, apparently, of a membraneous sac, or bag, containing a fluid matter, in which swims the embryo of the future chick, and seemingly connected with other vesicles around it.

"1st Day.—In a few hours after exposure to the proper temperature, the microscope discovers that a humid matter has formed within the lineaments of the embryo; and, at the expiration of twelve or fourteen hours, this matter evidently bears some resemblance to the shape of a little head; a number of new vesicles also successively appear, rudimentary of different parts of the future body of the chick; those first formed, and most easily distinguishable, may afterwards be recognized as assuming the shape of the vertebral bones of the back.

"2d Day.—The eyes begin to make their appearance about the thirtieth hour, and additional vessels, closely joined together, indicate the situation of the navel. The brain and spinal marrow, some rudiments of the wings and principal muscles become observable. The formation of the heart is also evidently proceeding.

"3d Day.—At the commencement of the third day, the beating of the heart is perceptible, although no blood is visible; a few hours, however, elapse, and two vesicles, containing blood, make their appearance,—one forming the left ventricle, the other the great artery. The auricle of the heart is next seen, and, in the whole of these, pulsation is evident.

"4th Day.—The wings now assume a more defined shape, and the increased size of the head renders the globules containing the brain, the beak, and the front and hind part of the head, distinctly visible.

"5th Day.—On the fifth day the liver makes its appearance, and both auricles now plainly seen, approach nearer the heart than they were before: that beautiful phenomenon, the circulation of the blood, is evident.

"6th Day.—The lungs and stomach are distinguishable, and the full gush of blood from the heart distinctly apparent.

"7th Day.—During this day, the intestines, veins, and upper mandible, become visible; and the brain begins to assume a consistent form.

"8th Day.—The beak, for the first time, opens, and the formation of flesh commences upon the breast.

'9th.—The deposition of matter, forming the ribs, takes place, and the gall-bladder is perceptible.

"10th Day.—The bile is now formed, or, at least, distinguishable by its green colour; and the first voluntary motion of the body of the chick is seen, if separated from its integuments.

"11th Day.—The matter forming the

skull now becomes cartilaginous, and the protrusion of feathers evident.

"12th Day.—The orbits of the sight are now apparent, and the ribs are perfected.

"13th Day.—The spleen gradually approaches to its proper position in the abdomen.

"14th Day.—The lungs become inclosed within the breast.

"15th, 16th, and 17th Days.—During these days, the infinity of phenomena in this wonderful piece of vital mechanism elaborate it into more perfect form, and it presents an appearance closely approaching the mature state. The yolk of the egg, however, from which it derives its nourishment, is still outside the body.

"18th Day.—On the eighteenth day, the outward and audible sign of developed life is apparent, by the faint piping of the chick being, for the first time, heard

"19th, 20th, and 21st Days.—Continually increasing in size and strength, the remainder of the yolk gradually becomes inclosed within its body; then, with uncommon power for so small and frail a being, it liberates itself from its prison in a peculiar and curious manner, by repeated efforts made with its bill, seconded by muscular exertion with its limbs, and emerges into a new existence.

"The position of the chicken in the shell, is such as to occupy the least possible space. The head, which is large and heavy in proportion to the rest of the body, is placed in front of the belly with its beak under the right wing; the feet are gathered up like a bird trussed for the spit, yet, in this singular manner, and apparently uncomfortable position, it is by no means cramped or confined, but performs all the necessary motions and efforts required for its liberation, with the most perfect ease, and that consummate skill which instinct renders almost infallible.

"The chicken, at the time it breaks the shell, is heavier than the whole egg was at first.

"An egg will not hatch in vacuo."

The eccaleobion is now exhibited at No. 121. Pall-mall; and we strongly recommend our readers to visit it, being convinced that very few can spend an hour in that place, without obtaining a valuable addition to their stock of knowledge.

COAL, IRON, AND STEAM.

It has been calculated, that in this country about fifteen thousand steam-engines are daily at work. One of those in Cornwall is said to have the power of a thousand horses; the power of each horse, according to Mr. Watt, being equal to that of five and a half men. Supposing, then, the average power of each steam-engine to be that of twenty-five horses, we have a total amount of steam power equal to that of about two millions of men. When we consider that a large proportion of this power is applied to move machinery, and that the amount of work now done by machinery in England has been supposed to be equivalent to that of between three and four hundred millions of men by direct labour, we are almost astounded at the influence of coal and iron and steam upon the fate and fortunes of the human race. "It is on the rivers," says Mr. Webster, "and the boatman may repose on his oars. It is in highways, and begins to exert itself along the courses of land conveyances. It is at the bottom of mines, a thousand" (he might have said one thousand eight hundred) "feet below the earth's surface. It is in the mill, and in the workshops of the trades. It rows, it pumps, it excavates, it carries, it draws, it lifts, it hammers, it spins, it weaves, it prints."

We need no further evidence to show that the presence of coal is, in an especial degree, the foundation of increasing population, riches, and power, and of improvement in almost every art which administers to the necessities and comfort of mankind. And however remote may have been the periods at which the materials of future beneficial dispensations were laid up in store, we may fairly assume, that besides the immediate purposes effected at or before the time of their deposition in the strata of the earth, an ulterior prospective view to the future uses of man, formed part of the design with which they were, ages ago, disposed in a manner so admirably adapted to the benefit of the human race."—*Buckland's Bridgewater Treatise.*

HINTS ON HEALTH.

(From Tilt's Table Almanack.)

January.—The invalid should watch with anxious solicitude the beaming of the midday sun, and seize upon so favourable an opportunity for taking exercise at short periods in the open air. The healthy should do so likewise, as by such means alone the body becomes invigorated, the mental powers increased, and the mischievous tendency to taking medicine frequently avoided.

February.—The exhilirating impressions produced upon the mind, by the increasing powers of the sun's rays during this month, should not induce the infirm of health to prolong their daily walk be-

yond noon. Let the dyspeptic dine at two, and employ himself with amusements congenial to his mind; if they are not of a sedentary nature, so much the better.

March.—March air has, unfortunately, ever been decried as injurious to the sickly, unless the stomach is well fortified by some warm potation to resist the rude attacks of Boreas. Gentle aperients taken during the mild weather, are calculated to be of much more essential service.

April.—Any sudden transition from established habits is extremely injudicious; this maxim applies to those who have during the winter indulged in warm clothing, and are now anxious to alter their habits without preliminary preparation. All who value their health should be careful to premise a draught or two of gentle medicine previous to any abridgment in their clothing.

May.—Every body should now avail themselves of that most salutary and natural exercise, walking; by means of which the appetite and perspiration are greatly promoted, the mind enlivened, and the motion of the lungs facilitated. No one can reasonably expect to enjoy life who neglects it.

June.—Such as are troubled with acidities, or whose food is apt to sour on the stomach, should avoid eating raw vegetables, which are now abundant and most inviting. Children of full habit will be much benefitted by a couple of doses of mild purgative modicine, such as calomel two grains, combined with julap six grains, and ginger two grains, followed by the usual black dose, as a preventive to gooseberry fever.

July.—The sea-side is now the favourite resort of many. Those who are subject to colds or coughs, or whose stomachs are weak, with loss of appetite, should begin with the tepid bath, and gradually decrease the temperature. By such means the body will become less susceptible of cold, and sea-bathing will be found of essential service when otherwise it would have been prejudicial.

August.—The liability to contract bowel complaints should render every one cautious how they indulge in watery liquors, salads, and raw fruits. Mild doses of rhubarb and magnesia, with two drops of the oil of carraway or cloves, taken twice a week, will be found the best means of regulating the bowels, and sheathing them from the acrid bile, which is now secreted in greater quantities.

September.—Man too frequently indulges in every species of food, and seizes upon every opportunity to gormandize: whilst such is the case, his ailments will not diminish. Stone fruits should be taken with precaution; if griping pains are occasioned, calomel four grains, followed by a table-spoonful of castor oil, with five drops of laudanum, is the best remedy. Repeat this if necessary.

October.—Those who have accustomed themselves to bathe during the summer, may now substitute salt and water, rubbing dry with a coarse towel. Remember that colds are now prevalent, and beware of foggy nights. The gouty, the dyspeptic, and the rheumatic, should guard against the vicissitudes of our temperature by consulting the thermometer, in preference to the looking-glass.

November.—The excessive humidity of the weather in November, produces in the inactive mental disquietude, frequently laying the foundation of nervous diseases; to prevent which, recourse should be had to exercise, equal clothing, and temperance in diet, avoiding the momentary excitement of cordials and other stimulants, temporarily effective, but permanently injurious.

December.—Great precaution should be taken by invalids, lest their maladies increase during this season of joy and festivity, when the animal system is apt to become replete. Let the gouty and rheumatic bear this in mind, and counteract the effects of feasting, by exercise in the open air, in preference to the warm fireside and luxurious sofa, with that bane to health—a newspaper.

THE CHEMIST.

ACIDS.

NO. V.

Chloriodic Acid may be obtained by passing chlorine into a vessel containing iodine: it is quickly absorbed, and a compound obtained, which is brown, when the iodine is in excess; colourless when exactly saturated; and yellow, if there be excess of chlorine. It is volatile, and may be distilled without decomposition. It tastes sour, and powerfully reddens litmus; it attracts moisture from the air, and dissolves readily in water. It appears to decompose the water, and form hydrochloric acid, and a compound of iodine and oxygen; but these combinations are not permanent.

Iodous acid is best obtained by introducing a mixture of one part of iodine and three parts of chlorate of potassa into a retort, and rapidly applying heat; a dense

fluid passes over, which should be collected in a receiver cooled by a freezing mixture. It has a pungent taste, and a peculiarly disagreeable odour. It reddens litmus, and forms a yellow solution when diluted with water. It slowly evaporates when exposed to the air, and rapidly volatilizes at 212°. It is decomposed by sulphur, disengaging a little heat, and liberating violet vapours: sulphurous acid also decomposes it. Phosphorus and potassium are instantly inflamed by it. It dissolves iodine.

Iodic acid is procured by acting upon protoxide, or peroxide of chlorine, by iodine; for this purpose the iodine may be introduced into a small flask, the oxide of chlorine disengaged upon it, from a mixture of chlorate of potassa and sulphuric acid, or 100 grains of chlorate of potassa, may be introduced into a small retort with 400 grains of liquid muriatic acid of the specific gravity 1·105; annex to the retort a small globular receiver (the receiver must have a bent tube issuing from it, and passing from the bottom of it to a small flask containing the iodine, about 50 grains), carefully apply the heat of a lamp to the retort, by which the oxide of chlorine will be disengaged, and which will be absorbed by the iodine. The aqueous solution of iodic acid first reddens, then destroys vegetable colours. Nitric, sulphuric, and phosphoric acids, when dropped into a hot saturated solution of iodic acid, forms ohrystallized compounds of a yellow colour. Muriatic and oxalic acids decompose it. Its compounds are called *iodates*.

Hydrobr mic acid gas may be obtained by acting upon bromide of potassium by sulphuric acid. This gas is colourless, sour, of a pungent and highly irritating odour, and yields dense vapours when mixed with humid air. It undergoes no change when passed through a red-hot tube, either alone or mixed with oxygen or iodine, but chlorine decomposes it, producing vapour and drops of chlorine. The attraction of oxygen and of bromine for hydrogen, is probably nearly equal, for bromine does not decompose water, nor does oxygen decompose the hydrobromic acid. Hydrobromic acid gas is rapidly absorbed by water; heat is evolved, and a fuming liquor obtained, which is colourless when pure, but which readily dissolves bromine, and acquires a yellow colour. This acid may also be obtained by the action of sulphuretted hydrogen on bromine and water. The liquid hydrobromic acid is instantly decomposed and discoloured by chlorine. Nitric acid also decomposes it, produces the evolution of bromine, and the formation of water and nitrous acid. This mixture dissolves gold. Its salts are termed *hydrobromates*.

MISCELLANEA.

Scent of Plants.—The scent of some plants is not perceptible until after they are cut down and exposed to the influence of either the sun or artificial heat. Grass, while growing, possesses no particular smell, but when made into hay, it scents the country around. The wood of the ash tree, when burned in a green state, will emit a fragrance like that which proceeds from the violet and mezerioh, and this it will diffuse to a very considerable distance. The glands of the frascinella, from which it exhales its scent, are large enough to be seen by the naked eye, and the vapour is so combustible, that it will burn when a light is placed within its influence. The garden nightshade has the property of causing sleep to overpower those who may inhale its odour; and the upas tree possesses an uncommonly deleterious quality of vapour. Some flowers emit their odours only at certain periods. Those having an embrosial smell exhale only after sunset, and the appearance of some plants corresponds with the nature of their scent. Musky-scented flowers are always of a yellowish and purple colour, and a dull appearance is indicative of the deleterious nature of their perfume. The odour of plants and flowers, which seems thus to inherit the property of creating such a diversity of feelings in the human frame, is considered by naturalists to be an excretory secretion, forming a gas or vapour, which in some is supposed to proceed from the petals transmitted from the plant by the claws at its base, and escaping through orifices on their surface, at others from the nectaries, or various parts which compose their blossoms.

The Typoface.—The Bordeaux papers mention that a young sculptor of that city has discovered a method of taking casts of the human face, which, without requiring that the features should be reduced to a state of perfect rigidity, allows them to preserve all their natural play, and thus produces an exact resemblance with the animamation of life. His name is Pellet, and he designates his apparatus the "Typoface."

Improvements in the Daguerreotype.—The means have just been found of engraving the Daguerrotype drawings, and of engraving them on the spot. This very important discovery is due to Dr. Donne, who has had the felicitous idea of applying the ordinary process of engraving directly to the proofs taken with the Daguerreotype. However extraordinary this result looks at first sight, it is not the less certain and authentic. We have examined the first plates obtained by that able observer. They have been submitted to the Academy of Sciences, where they have caused a very great sensation. Dr. Donne's discovery appears to us almost as important as that of the Daguerreotype itself. When he shall have brought to perfection his engraving process, then only will the Daguerre apparatus prove to the traveller, antiquary, and naturalist, the most valuable resource. When the image of the most

complex monument or most minute preparation of natural history shall have been finished, every traveller or observer, by immediately engraving the plate, will be able to compose himself the picturesque part of his work, and to multiply its proofs at a cheap rate. The primitive art, which obliged us to make collections of unique pictures upon silver plates, is therefore about to take a far wider range. It will quit the cabinets of the curious, and enter the domain of the graphic arts in general, and of popular education.—*Paris paper.*

New Musical Instrument.—One of the most ingenious musical instruments for years presented to the public, has been lately invented by Mr. Jenkinson, the organist of Lurgan church. The principle, though not altogether novel, is improved upon in a manner quite unique. It consists of a large violin body without neck or fingerboard, placed horizontally on a frame, having a greater number of strings than the violoncello, which are acted on by a bow at the one end, and a key-board, as in the pianoforte, answering to the left hand of the violin player The entire of the strings are at once under the movement of the bow; and, to avoid the discordant effect which must ensue when the piano tone is required, any string is made removeable at pleasure from the touch of the bow, by the simple contrivance of a few treddles, wrought with the foot and connected with a damper in the inside of the instrument. One great beauty of the invention is, that by the judicious disposition of the stops, each one produces the full chord of any key in which the performer thinks proper to play. The tone is most powerful; and, from the vast variety of notes capable of being produced, it forms one of the best orchestral instruments which we have seen. The writer heard it accompanying a grand piano, and the tone of the latter in some instances was wholly drowned by the strength of Mr. Jenkinson's instrument.—*Belfast News Letter.*

To discover whether Flour be Adulterated with Chalk or Whiting.—Mix with the flour some lemon or good vinegar; if the flour be pure, they will remain together at rest, but if there be a mixture of whiting or chalk, a fermentation or working like yeast will ensue. The adulterated meal is whiter and heavier than the good. The quantity that an ordinary tea-cup will contain, has been found to weigh more than the quantity of genuine flour by four drachms.

Steaming and Staging.—According to a statement in the *Railway Times*, it would not at first sight appear that so extensive an injury as might have been expected, has been done to stage-coach travelling by the competition of railways. That paper states the "official returns" to show that the combined duty received from stage carriages and railways for the year ending 5th of January, 1835, amounted to 487,823*l.* while for the year ending 5th of January, 1839, it reached to 494,284*l.*, the increase from the one kind of travelling having exceeded the decrease on the other. Thus, in 1835, the stage-carriage duty amounted to 486,892*l.*, and in 1839 to 454,714*l.*, leaving a deficiency of 32,178*l.*; whereas the railway duty was in 1835 only 931*l.*, and in 1839, 39,570, being an increase of 38,639*l.* It must be remembered, however, that although the reduction of the coach duty is small in reference to the whole amount, it has fallen only upon particular lines of road, and there its pressure upon the property invested must have been very severe.

Learning, if rightly applied, makes a young man thinking, attentive, and industrious, confident, and wary: an old man, cheerful and reserved. 'Tis an ornament in prosperity, a refuge in adversity, an entertainment at all times; it cheers in solitude, and moderates upon a throne.

White Teeth.—The following is strikingly illustrative of the acute perception of the blind. The celebrated Saunderson, although completely blind, and who occupied in so distinguished a manner the chair of mathematics in the University of Cambridge, being one day in a large company, remarked of a lady who had left the room, but of whom he had never before met, nor even heard of, that she had very white teeth. The company were extremely anxious to learn how he had discovered this, for it happened to be true. I have no reason," said the Professor, "to believe that the lady is a fool, and I can think of no other motive for her laughing incessantly as she did for a whole hour together."

Rob Roy's Violin.—A gentleman in the neighbourhood of Kinross has an old violin, which was long in the possession of a Highland gentleman of Perthshire, well known in his day for his musical talent. On the inside is written "Robert Roy Macgregor, 1660."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Nov. 6, A. J. Mason, Esq., Sketches of the United States, Geographical, Political, and Moral. Friday, Nov. 8, B. R. Haydon, on the History of Art, from the earliest time. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 7, Edward Taylor, Esq., Gresham Professor of Music, on Vocal Harmony. To commence at eight o'clock.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Nov. 8, G. F. Richardson, Esq., (of the British Museum), on Corals. At half past eight.

QUERIES.

Is there any method of colouring hair (say red, for instance), so as to leave it nearly white?—Of what materials are the small models of the Egyptian obelisks made (I believe the black is coal), and the manner of manufacturing them.

C. M. X.

If 12 quarts of wine be taken out of a wine tub, and 12 quarts of water be poured into it; if this operation be repeated four times, and if there then remain 54 quarts of pure wine in the tub, what was the original quantity contained therein?

B. C.

The best and easiest method of dyeing various parts of white silk crimson and Prussian blue?

S. G. S. F.

1. How is the expansion of water, both by heat and cold, to be reconciled, or how explained? 2. At what rate does air expand, and at what temperatures? 3. In what proportion does the mercury in the barometer sink, in ascending the air; and supposing the mercury stood at 52°, what would be the actual height of the iustrument? 4. In what proportion does the heat increase towards the centre of the earth? What loss of power is generally allowed for friction in machinery? 6. How is the power of an hydraulic press computed; suppose, for instance, the diameter of cylinder was 16 inches, and the height of column of water 6 feet, what would be the force exerted? 7. The standard for levelling is low-water mark; how is this found? D. J.

The process of making carmine from the cochineal insect? A SUBSCRIBER.
Chelsea.

ANSWERS TO QUERIES.

To obtain a Persulphate of Iron.—"Juvenile Entertainer." I think *per*sulphate of iron, not *pre*sulphate. I never heard of the latter. I send the mode of preparing the persulphate:—Dissolve the moist red oxide of iron in sulphuric acid, and the product will be persulphate of iron. It may be also formed by addiug sulphuric acid to the solution of the sulphate of iron, heating the mixture, and dropping into it nitric acid sufficient to peroxide the salt. It does not crystallize, but affords, by evaporation, a brown deliquescent mass. J. MITCHELL.

The preparation of Lutes.—Under the term *lutes*, a variety of compounds are used by the practical chemist for the purpose of seeuring the junctures of vessels, or protecting them from the action of heat. Glaziers' putty is a very good lute for all the common purposes of a laboratory; but it is necessary that the whiting be first thoroughly dried before it is mixed with the oil. Linseed oil and sifted slaked lime, well mixed and made thoroughly plastic, form an excellent coatiug for retorts; if made thicker, this mixture is an impenetrable lutiug, that is not liable to crack. A mixture of four parts sand and one of common clay, was recommended by Dr. Black as a good common lute, except where it is to be exposed to an intense heat; in such situations, he advised to use six parts of sand and one of clay. A mixture of martial pyrites and muriate of ammonia, forms a good lute for stopping the cracks of iron utensils; but the following artificial compound is preferred, on account of the proportion of the ingredients being more exactly ascertained:—To two pounds of iron turnings or filings add one ounce of sal ammoniac, and one ounce of flour of sulphur; blend the mixture with water till the whole of it is of a proper consistence. This lute is employed by engineers to stop the joints of steam engines, &c. A mixture of salt and whiting, kneaded with water, makes a very hard and durable lute for many purposes, particularly for securing the joints of the apparatus for the production of carburetted hydrogen. Slips of wetted bladder, or a paste made of linseed meal and water, forms a very useful lute. J. MITCHELL.

To make an Infusion of Gentian.—"F. F. F." Sliced gentian root, half an ounce; dried bitter orange peel and coriander seeds, of each one drachm; boiling water, twelve liquid ounces. Macerate one hour in a lightly-covered vessel, and then strain.

To make Boots Waterproof.—"W. J." Dissolve India-rubber (cut into small pieces) in spirit of turpentine, by placing the phial, or small jar containing it, in a saucepan of water over the fire, and stirring or shaking it occasionally. When perfectly fluid, apply it warm to the boots, with a piece of flannel or rag, till the leather appears saturated, and they will resist snow or water It should not be very thick or cool, or it will remain on the surface instead of penetrating the leather. The smell of the turpentine will soon pass off on exposure to the air.

To Varnish the Silk of a Balloon.—"G. H. S." Dissolve Indian-rubber in five times its weight of oil of turpentine, and this solution again dissolved in eight times its weight of drying linseed oil by boiling. DISCIPULUS.

TO CORRESPONDENTS.

H. S.—*The length of a pendulum vibrating seconds* in the latitude of London, *is* 39.2 *inches. The time of an oscillation varies as the square root of the length of the string; but if the force of gravity (which varies in different latitudes) be not given, the time of an oscillation varies as the square root of the length directly, and as the square root of the force of gravity inversely.*

W. J. Cuthbert *in our next.*

T. S. J.—*His suggestions shall not be disregarded; but we still are of opinion, that numbering queries and answers would be less convenient than repeating the object of enquiry at the time it is answered, which renders the subject intelligible, without the necessity of referring to former numbers. We thank him for his good wishes, and feel flattered by the terms in which he expresses his approbation.*

Proportio.—*The delay which occurred in the insertion of his last article on architecture was occasioned by the engraving, which is more than usually complicated. We take this opportunity of thanking him for his interesting papers, and expressing a hope that he may long continue a correspondent of the "Mechanic."*

H. B. I. *will find several receipts for dying hair black in t e last volume of the "Mechanic." Nitrate of silver (lunar caustic) will produce that effect, but it also stains the skin, and almost everything it touches. It will even stain a common flint, and figures have been formed by this means, which have passed with connoiseurs for natural veins called* lusus naturæ.

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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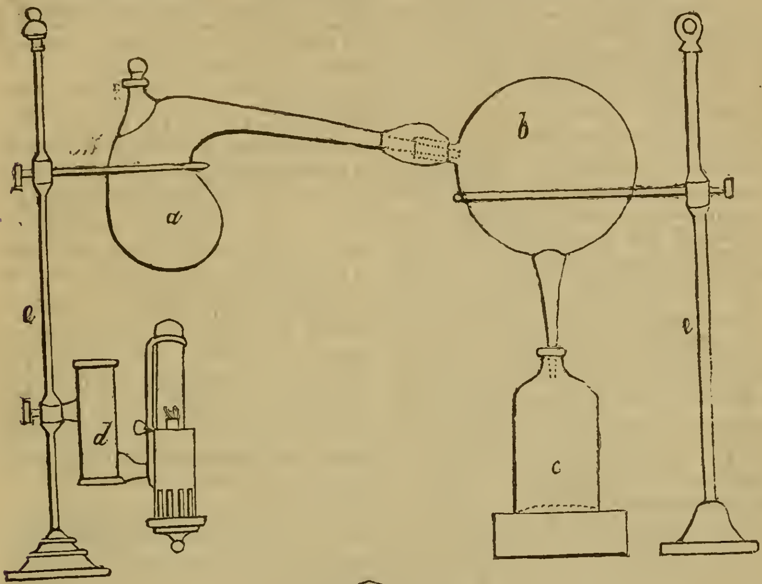
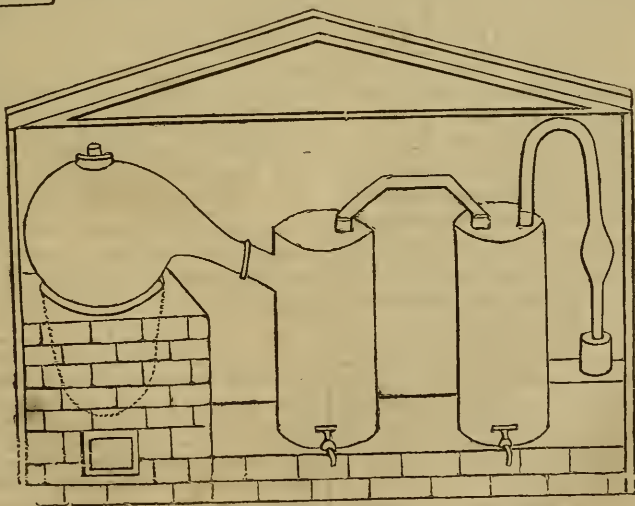
MITCHELL'S APPARATUS FOR MAKING NITRIC ACID.





 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney

LOCOMOTIVE POWER APPIED TO CANAL TRANSIT.

A SHORT time ago an experiment was conducted on the Forth and Clyde Canal, of a novel and highly interesting nature, by John Macneil, C. E., and consulting engineer to the Canal Company. It is well known that the haulage of boats on this canal has hitherto been performed by horses, the rates of speed being for the heavy sloops, brigs, &c., in the London, Dundee, and other trades, about one and a half to two miles per hour, when drawn by two or five horses, according to the state of the weather, and for the swift or passenger boats, between eight and nine miles an hour on an average, when drawn by two horses. The object of the experiment was to ascertain the possibility of using locomotive steam power to draw the boats instead of horses; accordingly a single line of rails upon blocks, like an ordinary railway, was laid down for a considerable space along the canal banks, near lock 16; and a locomotive engine and tender, built by Mr. Dodds, having been brought down the canal and set on the rails, on the morning of the 21st, Mr. Macneil, Mr. Johnson, the canal director, and several engineers and gentlemen being present, the experiment commenced by attaching to the engine the towing line of the first passenger boat that made its appearance, and which contained upwards of ninety passengers, with their luggage.

There was a trifling delay in disengaging the horses and tying the line to the engine, but this was amply compensated when the *Victoria* briskly set off, and almost immediately gained a speed of seventeen and one-third miles per hour, which she kept up round two curves, and until the termination of the rails made it necessary to stop, amid the cheers of the delighted passengers. This experiment was repeated during the course of the day, with each passenger boat as it came to the railed space, and with equal success each time. On one occasion a towing-rope, which was much decayed, got foul with a curb-stone and broke, but without causing the slightest inconvenience, except about one minute's delay. The engine employed being intended only for a slow trade, was not calculated to go at greater speed than eighteen miles per hour, but it was the opinion of all present, that with proper passenger-locomotives, a speed might be obtained equal to that upon the best railways, few of the latter possessing the advantages secured by the canal bank of a perfect level throughout.

The nature of the motion was highly gratifying to all the passengers, being more uniform, steady, and smooth, than when the boats were drawn by horses.

Several of the heavy (masted) vessels were also taken in tow during the two days of trial, at the rates of three, three and a half, four, and five miles an hour; and, on one occasion, two loaded sloops, and a large waggon boat, were together attached to the engine, and hauled with ease at the rate of two and three quarters miles per hour, whilst only one-fourth of the steam was allowed to pass the throttle valve.

The foregoing statements render palpably apparent the immense advantages which might be gained by this new adaptation of steam power—a great economy in haulage expenses, as one engine might draw at least six sloops, which now would require from eighteen to twenty-four horses, and, if necessary, at double the present speed; and a proportional increase of the important traffic on the canal, which might be reasonably expected.

Passengers would increase in great proportion when attracted by economy and speed of transport. The Union Canal might be traversed in two hours, and the Forth and Clyde Canal in one and a half, instead of four hours and three and a half, as at present, and this by only assuming sixteen miles per hour, though more might easily be performed, as the experiments have shown.

The foregoing is from the *Glasgow Courier*; it is much to be regretted that newspapers in this country should be so deplorably deficient in scientific knowledge, as they almost all appear to be. We should have deemed the proposal of dragging barges through the water with a speed equal to that of trains on the best railways, sufficiently monstrous for any sober Scotchman; but when we are told that few railways possess the advantage of *a perfect level throughout*, "secured by the canal bank," although the experiment is stated to have been tried at the sixteenth lock, which implies considerable deviation from the horizontal line, we are inclined to suspect that the article was intended for the sister island, or the slick citizens of New York.

The subject of canal conveyance is one of great importance, and has recently occupied the attention of the French Academy. At the meeting of the 14th of October, the indefatigable M. Arago communicated to the learned assembly, a letter from Mr. Robinson on the subject of the experiments above described. It has been found that much advantage is obtained by

maintaining a great speed in canal boats, so as to prevent the formation of the wave which, at low speeds, is observed before the boat, extending to, and injuring the banks, as well as impeding the progress of the vessel. These experiments have been repeated in France, and there is now a regular conveyance of this kind established on the canal de l'Ourcq, between Paris and Meaux. The horses employed must be well taught to start without hesitation, and continue without any diminution of speed; for if the wave is once formed, it cannot be surmounted without great difficulty during the remainder of the passage. The steam locomotive possesses the requisite properties for this object; but it is a question worthy of consideration, whether, in many cases, it would not be more advantageous to place the engine in the boat, when an unobjectionable mode of propulsion is devised.

THE LIONS OF LONDON.

It has long been matter of regret to the lovers of science and art, that our national exhibitions were so inaccessible to the mass of the people, while in France, and other foreign countries, they were open to all who chose to frequent them. The narrow-mindedness of past days is, however, fast passing away; and partly through the influence of private individuals, partly by the provisions of government, and by the exertions of a society formed for the express purpose of affording the greatest possible facility for viewing these collections of the wonders of nature and art, the doors of many of the national exhibitions are now accessible gratuitously, at all reasonable hours, and many others will soon be thrown open. The publisher inserts here for the information of his numerous readers, especially such as may have occasion to visit London, a short account of the above most excellent society, and a list of the places already open to the public.

Society for obtaining free access for the People to National Monuments, and to Public Edifices containing Works of Art.

President—His Royal Highness the Duke of Sussex.

Vice-Presidents.

The most Noble the Marquis of Westminster.
Right Honourable Lord Hatherton.
N. Ridley Coleman, Esq., M.P.
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The object of this society is to procure for the people opportunities of intellectual recreation, and thereby lead them from dissipation or idleness to the cultivation of their understanding, the refinement of their taste, and a due appreciation of merit.

The society to consist of subscribers of one guinea for the first year, and five shillings each succeeding year.

The annual meeting of the society to be held in April or May, for the election of officers and for general business. Other general meetings to be held monthly, from November to July, and the progress made by the society duly reported.

Persons desirous of joining the society, or of giving information of Museums and collections of art or natural history open to the public, are requested to communicate with some member of the committee, or with the Hon. Secretary, 7, Manchester-street, Manchester-square.

Ladies are especially invited to join a society so conducive to the extension of civilization among the people. A list of the members will be published with the annual report.

The public are already admitted without any payment to

The Tower of London.

The British Museum—Monday, Wednesday, and Friday, and the whole of Easter and Whitsun weeks except Saturday, from 10 till 4; from May to September, 10 to 7; closed the first week in January, May, and September, and on Christmas day, Good Friday, and Ash Wednesday.—Young children excluded on holidays.

National Gallery—Monday, Tuesday, Wednesday, and Thursday, and the whole of Easter and Whitsun weeks except Saturday, from 10 till 5; closed for six weeks from the end of the second week in September, and on Christmas day and Good Friday.

St. Paul's—Each week day from 9 to 11, and from 3 to 4; and on Sunday from 10 to 12, and from 3 to 5. Visitors when in, may remain till dusk on week days.

East India House Museum—Saturday, from 11 to 3; all the year except in September.

Soane Museum—Thursday and Friday during April, May, and June only, from 10 to 4. Tickets must be applied for previously, and will be sent by post.

Society of Arts—Any day except Wednesday, to strangers and mechanics.

Hampton Court Palace—Arrangements are being made to admit *freely* Monday, Tuesday, Thursday, and Friday.

Kew Gardens—Pleasure grounds, Sunday and Thursday, free, from 12 till sunset, from Midsummer to Michaelmas; the Botanical Gardens and Arboretum every day, to intelligent strangers, from 1 to 3, at any season.

Dulwich Gallery—Each week day, except Friday, from 10 to 5 in summer, and from 11 to 3 in winter. Tickets to be had gratis from the principal printsellers in London. Children under 14 jected to.

Norwich Cathedral—One hour each week day, in addition to hours of service.

Bath Cathedral—At all times.

Dover Philosophical Institution—Every Monday; principally Natural History.

Truro Museum—Daily; Minerals.

Royal Dublin Society—Museum and Botanical Gardens Tuesday and Friday; Gallery of Casts Wednesday and Saturday, from 12 to 4.

Edinburgh College of Surgeons' Museum—Four times a week.—*Noble's Compendium.*

DR. TURNBULL'S SUCCESS IN THE CURE OF DEAFNESS.

We paid Dr. Turnbull a second visit a few days since, and were extremely gratified. One case, in particular, came under our notice, in which, during a very short space of time—say ten or twelve minutes—we beheld a very obvious improvement. It was that of a young lady, probably about eighteen years of age, who had been both deaf and dumb from her birth. When she entered the room she could not hear a syllable which was uttered, nor did she recognize the least sound, though two books were struck violently against each other, close by her ear. We never saw a more lamentable deficiency in the organ of hearing. The Doctor resorted to his usual mode of restoration,—namely, pouring a small quantity of some liquid into the ear, and stirring it round the interior with a piece of soft leather;—having continued this for about five minutes, he repeated the experiment before alluded to, striking the book, however, much more moderately; this his patient heard; the Doctor then spoke to her, and she readily replied by signs that she heard and understood him. The first letters of the alphabet were now spoken one by one to her, and she, after a few efforts, repeated them with very tolerable accuracy, proving, beyond a doubt, that a great improvement had taken place.

Another case was that of an interesting little boy, about six years of age, named Wells, who was likewise deaf and dumb from his infancy. Through the instrumentality of Dr. Turnbull, hearing was in a great measure communicated, and the little fellow was enabled to utter many words with the greatest promptitude and clearness.

The variety of cases which come under the Doctor's notice, are singularly numerous and pleasing. One at the present time is that of a respectable family from Scotland, five of whom are deaf; another, that of a young gentleman of fortune, whose relatives have recently returned with him from Paris, where he has been under some of the most eminent physicians; the sight was peculiarly touching when the youth returned to the room where we were sitting, to meet those of his friends who had not attended him whilst under the Doctor's hands; perceiving how readily he replied to their first inquiries, they burst into tears of gratitude and joy, from a consciousness of the improvement which had been effected; another case—to mention no more—struck us as very peculiar; it was that of a man and his wife, who were both deaf and dumb, and whose only intercourse with each other was kept up by a rapid succession of signs made by their fingers. If we recollect right, they had three children, all deaf and dumb.

Highly pleased with what we have seen, we say to Dr. Turnbull, by way of concluding our remarks, "Go on, Doctor, and prosper!"

ANTHRACITE COAL.

At the recent meeting of the British Association, Mr. Player read the following paper on the application of anthracite coal to the blast furnace, steam-engine boiler, and smith's fire, at the Gwendraeth iron works near Carmarthen:—

The inconvenience of the fire choking for a long time baffled the experiments made on the subject, but it was at last obviated by heating the coal before it reaches the fire, which was accomplished by supplying it, without any mixture of coke or bituminous coal, through a per-

pendicular chamber placed centrally on the top of the boiler, with an opening about twenty inches in diameter immediately over the fire place. In passing through this chamber, by its contact with the plates, the coal acquires considerable heat, and descending by its own gravity, as the fire consumes beneath, replaces what has been burnt, by which means a regular supply of fuel is furnished, fit for immediate and complete ignition. Another inconvenience is also thus avoided, as fresh coal thrown upon the fire abstracts a quantity of heat from the fuel already in ignition, and checks the generation of steam. The fire is never meddled with; there are no fire drawers; there is no current of cold air passing through the flues, and a very small amount only of draught is required. One engine worked seventy-two hours consecutively, during which time the grate neither choked nor clinkered; nor was a bar used for the fire, or did there remain any considerable result in ashes. The coal was, in this instance, entirely anthracite (small, but not powdery) and tipped into the feeding chamber once every four hours. Water was also kept in the ash-pit, the steam from which, being decomposed by passing through the fire, the gas forms a jet of flame, creating another active source of power. On these works, there are in action upon this principle, five smiths' fires, the tool maker's fire being blown by a 30-inch bellows only, whilst with this the largest squaring edges for the masons are made with ease. The coal is supplied through an upright brick flue, about three feet six inches high, two feet six inches long, and nine inches wide. The foundry has a similar arrangement, with merely the addition of a flue to take off the flame, the blast being cold, and worked by a small water-wheel, and by which iron is re-melted, running very fluid, and yielding an excellent quality. An oven has also been built for the use of the workmen, heated only with small culm, which succeeds admirably.

ZOOLOGICAL SOCIETY.

Strange, if true.—At the ordinary scientific meeting, on Tuesday evening, F. Wishaw, Esq., in the chair, the first communication read was a letter from Mr. Mackay, of the British consulate at Maracaibo, on a plant called Projojoy, in the country from which it was derived, and which arrives in this state from the strange metamorphose of an insect. In the insect which was described, some of the legs have been already changed into roots, and in this state it was presented to the contributor. It was announced that a similar insect had lately been discovered in North Carolina. When this creature assumes the form of an insect or animal, it is about an inch in length, and much resembles a wasp in appearance. When the insect has attained its full length, it disappears under the surface of the ground and dies, soon after which the two fore-legs begin to sprout and vegetate, the shoots extending upwards, and the plants in a short time reaching a height of six inches. The branches and the leaves are like trefoil, and at the extremities of the former there are buds which contain neither leaves nor flowers, but an insect, which, as it grows, falls to the ground or remains on its parent plant, feeding on the leaves till the plant is exhausted, when the insect returns to the earth and the plant roots forth again.

[We should feel particularly obliged to Mr. Mackáy, if he would take this back and make some slight alterations in it, as it will be found difficult to persuade any one to believe it in its present state. This is not the first story of the kind we have heard; and we should be glad if any of our readers could suggest a reasonable explanation of the appearances which have led to so strange a statement.—Ed.]

THE CHEMIST.

ACIDS.

NO. VI.

(See engraving, front page.)

Nitric acid is usually obtained by distillation of purified nitre with sulphuric acid, of which material different proportions are employed. The nitric acid of commerce, which is generally red and fuming, in consequence of the presence of nitrous acid, is procured by the distillation of one part of sulphuric acid with two parts of nitre; these proportions afford about one part of orange-coloured nitric acid of the specific gravity of 1.48. Upon the large scale, 112 lbs. of nitre and 56 lbs. of sulphuric acid, yield from 50 to 52 lbs. of nitric acid. Some manufacturers employ three parts of nitre and two of sulphuric acid, and the *London Pharmacopœia* direct equal weights of nitre and sulphuric acid, by which a nearly colourless nitric acid is produced, provided the distillation be conducted at as low a temperature as possible. The distillation of nitric acid may be conducted upon a small scale in a

tubulated glass retort, *a* (see engraving, fig. 1), with a tubulated receiver, *b*, passing into the bottle, *c*. The requisite heat is obtained by the lamp, *d*, and the whole apparatus supported by the brass stands, with sliding rings, *e e*. But the manufacturer who prepares nitric acid upon the large scale, generally employs distillatory vessels of stone ware. Fig. 2 represents the arrangement of the distillatory apparatus employed at Apothecaries' Hall for the production of common *aquafortis*. It consists of an iron pot set in brick-work over a fire-place, an earthen head is luted upon it, communicating with two or more receivers of the same material, furnished with earthenware stopcocks, the last of which has a tube of safety dipping into a basin of water. The nitric acid of commerce, as obtained by the above processes, is always impure, and muriatic and sulphuric acids may usually be detected in it. The former may be separated by nitrate of silver, and the latter by a very dilute solution of nitrate of baryta. To obtain pure nitric acid, therefore, add to that of commerce a solution of nitrate of silver as long as it produces any white precipitate, and when this has subsided, pour off the clear liquor, and add in the same way the nitrate of baryta, then distil the acid, and it will pass over perfectly pure. Nitric acid is a colourless liquid, extremely sour and corrosive, and very intense in its action upon the greater number of inflammable bodies. Its specific gravity, as usually obtained, fluctuates between 1.4 and 1.5. At 40° the concentrated acid congeals; when diluted with half its weight of water, it freezes at about 2° below 0°. Its salts are called *nitrates*.

Nitrous acid may be obtained by mixing two volumes of nitric oxide with one volume of oxygen; much heat is evolved, and the gasses become condensed to one-third their original volume, and form nitrous acid or rather vapour, for it is condensed at 0°. This gas supports the combustion of a taper of phosphorus and of charcoal, but extinguishes sulphur. It is readily absorbed by water, forming a sour liquid. Its specific gravity is as 3.162 to 1.000. It forms salts termed *nitrites*.

Hydrochloric acid may be readily procured by acting upon common salt or sal ammoniac by sulphuric acid: the evolved gas must be collected over mercury. The salt should be put in fragments into a small tubulated retort, which may be one-fourth filled with it; the sulphuric acid should barely cover the pieces of salt; the gas is instantly extricated, and when its evolution slackens, it may be quickened by the gentle heat of a lamp. It is convenient to put a long strip of folded blotting paper into the neck of the retort, which absorbs any liquid which may chance to go over, and prevents its soiling the mercury. Hydrochloric acid gas is perfectly unrespirable; it extinguishes the flame of a taper. Although permanently gaseous at all common temperatures and pressures, Mr. Faraday liquified this gas by genarating it in a sealed tube, so as to expose it to a pressure of about forty atmospheres at 50°. It was colourless, and possessed a refractive power inferior to that of water. Hydrochloric acid gas has a strong attraction for water; when it escapes into the air it forms visible fumes, arising from its combination with aerial vapour. A piece of ice let up into the gas over mercury, immediately liquifies it and absorbs it; and if a tall jar of the gas be carefully transferred, with its mouth downwards, from the mercurial to the water-trough, the water instantly rushes in with violence and fills it. Litmus paper is powerfully reddened by this gas. Water takes up 480 times its bulk of muriatic acid gas, and has its specific gravity increased from 1 to 1.210. This may be shown by throwing up a few drops of water into a tall jar of the gas standing over mercury, the gas disappears, and the mercury fills the vessel. There is considerable elevation of temperature during the condensation of the gas. When the liquid acid is pure, it is perfectly colourless, but it generally has a yellow hue, arising from particles of cork or lute that have accidentally fallen into it, or sometimes from a little iron. The acid of commerce almost always contains iron and sulphuric acid, and sometimes nitric acid. The concentrated acid emits fumes; when exposed to the air, it boils at a temperature of 112°, and gives off the gaseous acid; it freezes at 60°. It is decomposed by the chloric, iodic, and bromic acids, and several of the metallic oxides. It forms salts called *hydrochlorates*.

Hydrocyanic or *Prussic acid*, may be obtained by introducing cyanuret of mercury into a tubulated glass retort, and pour upon it rather less than its weight of muriatic acid (specific gravity 1.200). Adapt a horizontal tube to the beak of the retort about two feet long and half an inch in diameter; fill the first third of the tube next the retort with small pieces of white marble, the other two-thirds with fragments of fused chloride of calcium, adapt to its end a small receiver surrounded by a freezing mixture; on applying a gentle heat to the retort, hydrocyanic vapour will pass through the tube, and be-

come condensed in the cold receiver; any portion of muriatic acid and watery vapour that may rise along with it, will be retained by the carbonate and chloride; after this part of the process, the whole length of the tube should be gently heated, to expel the residuary hydrocyanic acid. Another mode of obtaining hydrocyanic acid, is that recommended by Vauquelin; it consists in placing cyanuret of mercury in a tube connected with a cooled receiver; sulphuretted hydrogen is then passed over the cyanuret, the sulphur of which combines with the mercury to form a sulphuret of mercury, and the hydrogen unites to the cyanogen to form hydrocyanic acid, the whole of which may be easily driven off by the application of a gentle heat into a cold receiver, and there condensed. The hydrocyanic acid thus obtained, has a strong pungent odour, very like that of bitter almonds; its taste is acid, and it is highly poisonous, so that the utmost care should be taken to avoid the inhalation of its vapour. It volatilizes so rapidly, as to freeze itself. It reddens litmus. The specific gravity of its vapour compared with hydrogen, is as 13.5 to 1. It consists of 1 volume of cyanogen + 1 volume of hydrogen, forming two volumes of the hydrocyanic vapour. Its salts are termed *hydrocyanates.*

J. Mitchell.

QUERY.

What will be the thickness of metal required for a concave copper ball, eight inches diameter without, so as to sink to its centre in common water?

ANSWER.

$\frac{.2618 \times 8^3}{27.7274} = 4.834$ lbs. weight of the hemisphere of water displaced, which is equal to the weight of the ball required, w.

A copper ball five inches in diameter weighs 21 lbs.; hence for any other,

$$5^3 : d^3 :: 21 : w = \frac{21\,d^3}{125} = \frac{d^3}{6} \text{ nearly.}$$

Hence $\frac{D^3 - d^3}{6} = w =$ weight of the shell in lbs. where D is the external and d the internal diameter.

$\therefore d = \sqrt[3]{D^3 - 6w} = \sqrt[3]{8^3 - 6 \times 4.834} = \sqrt[3]{483} = 7.845$ internal diameter, which deducted from 8, leaves .155 difference of diameters; half of this $= .0775 =$ rather more than one-thirteenth of an inch for the thickness of the ball.

The same, by the Slide Rule.—To 5.96 of A set 8 of the slide; over 8 of D is 85 lbs., the weight of a solid globe of copper.

To 105.9 of A set 8 of the slide; over 8 of D is 4.83 lbs., the weight of the displaced water.

$$85 - 4.83 = 80.17.$$

To 5.96 of A set 80.17 on the slide inverted; the point where equal values meet is 7.85 & $8 - 7.85 = 15$.

Then $\frac{.15}{2} = .075 = \frac{1}{13}$th of an inch as before.

W. W.

MISCELLANEA.

The First Railroad in Italy.—The railroad from Naples to Castellamare was opened on the 3rd ult. by the King in person. His Majesty, on alighting with the royal family, was received by the Minister of the Interior, a commissioner appointed by the French shareholders of the company, and the chief engineer. M. Dubois, the French commissioner, made a suitable address to his Majesty, to which the King replied, "I have given my entire protection to this the first essay of the kind in Italy, and being convinced of its utility, I contemplate in the termination of your works as far as Nocera and Castella, a continuance of the communication by Avellina to the Atlantic." The King then minutely examined the locomotive engines and other parts of the establishment, and returned to Naples. M. Dubois and M. Bayard, the chief engineers, have been created knights of the order of Merit of Francis the First.—*Morning Paper.*

Chemical Powers of Light.—M. Edmond Becquerel has recently communicated to the Académie des Sciences, some important investigations on the chemical powers of solar light, which will probably lead to new and valuable results. It has been long known that light has the power of variously affecting certain chemical compounds; sometimes causing combination between two elements, and in other cases effecting the decomposition of compound substances; and it has been found that when a pencil of light is decomposed by passing through a prism of glass, those rays which possess this power are differently refracted from the coloured rays, and hence the existence of peculiar rays, to which the name *chemical rays* is given, has been deduced. The chief difficulty in experiments on these rays has been, the slow nature of the actions caused, and the difficulty of appreciating them. M. Becquerel has overcome these sources of uncertainty, and is enabled to study the chemical powers of light with ease, and measure the effects produced, with considerable accuracy. The manner in which this is done is very simple. Two liquids of different densities, but both conductors of electricity, and of such nature as to act chemically upon each other when exposed to the influence of solar light, are selected; and a portion of both is put into a cylindrical vessel blackened on the exterior. A plate of platinum is placed in the denser of the two fluids, and another similar plate is also immersed in the lighter liquid; these plates being then connected by means of platinum wires with the two terminations of a very delicate galvanometer, the apparatus is complete. If when thus arranged a ray of light is suffered to pass through the mass of fluid, it causes chemical action to take place at the surface of contact between the two liquids, and a current of electricity which this sets in circulation is immediately rendered evident by the galvanometer. As the angle of deflection of the galvanometer indicates the power of the electric current, and as this is in exact proportion to the chemical action which originates it, it is evident that this arrangement gives an accurate measure of the power of the chemical rays of light, at different times, from different sources, and under various circumstances. M. Becquerel details some experiments on the quantity of these chemical rays, which is intercepted when a ray of light is made to pass through screens of different substances, such as rock crystal, mica, and variously-coloured glasses; and states that he is still engaged in experimenting on the subject.—*Athenæum.*

A Short Name.—The Dutch journals announce that King William has invested the Sultan of Djocjokata, with the dignity of commander of the order of the Lion of the Netherlands; the Sultan's name is

Hamankoeboewonosenopatiingalogongabgurrachmansaydinpnnotogomode, the Fifth.

To make Oats doubly Nutritious.—Instead of grinding the oats, break them in a mill, and the same quantity will be doubly nutritious. Another method is, to boil the corn and give it to the horses with the liquor in which it has been boiled; the result will be, that instead of six bushels in a crude state, three bushels so prepared will be found to answer, and to keep the animals in superior vigour and condition.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton, Buildings, Chancery-lane. Wednesday, Nov. 13, A. J. Mason, Esq., Sketches of the United States, Geographical, Political, and Moral. Friday, Nov. 15, B. R. Haydon, on the History of Art, from the earliest time. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 14, H. W. Woelrych, Esq., on Education. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Nov. 15, Mr. Joshua Crockforn, on the Application of the Force of Gravity. At half-past eight.

QUERIES.

How to make blue ink that will not change its colour? V. T. Z.

What will turn brass to a steel or any dark colour, so that it will polish the same as any other metal? C—s C—s.

TO CORRESPONDENTS.

Alpha.—*The experiments of M. Despretz concerning the transmission of heat in liquids, were minutely described in a recent number of the "Mechanic."*

Gulphy *wishes to know which are the best works on boxing, wrestling, and fencing: for the first, we should say that the best books are those which condemn the practice in the strongest terms of reprobation; as for fencing, it may be well enough between a butcher and a pig or a sheep, and perhaps necessary for some military men; but those who persuade youth that sticking or shooting one another is honourable, merit the abhorrence of all good and sensible men. Scratching and biting may be considered as honour amongst the grey rats of Montfaucon, or the toads and water lizards in a horse pond; but it is not so between men; a generous heart and a spotless mind, that is true honour; and let those who pretend that honour is derived from the mutilation of their fellow-creatures, be consistent, and bow down with reverence to the Tom Cat, who, according to the principles which they propound, must be more honourable than any two-legged gentlemen upon earth.*

J. Mitchell *is requested to oblige "Juvenile Entertainer" with his address, that gentleman having some chemical discovery to communicate.*

W. P. *and* E. P. *shall be answered in our next.*

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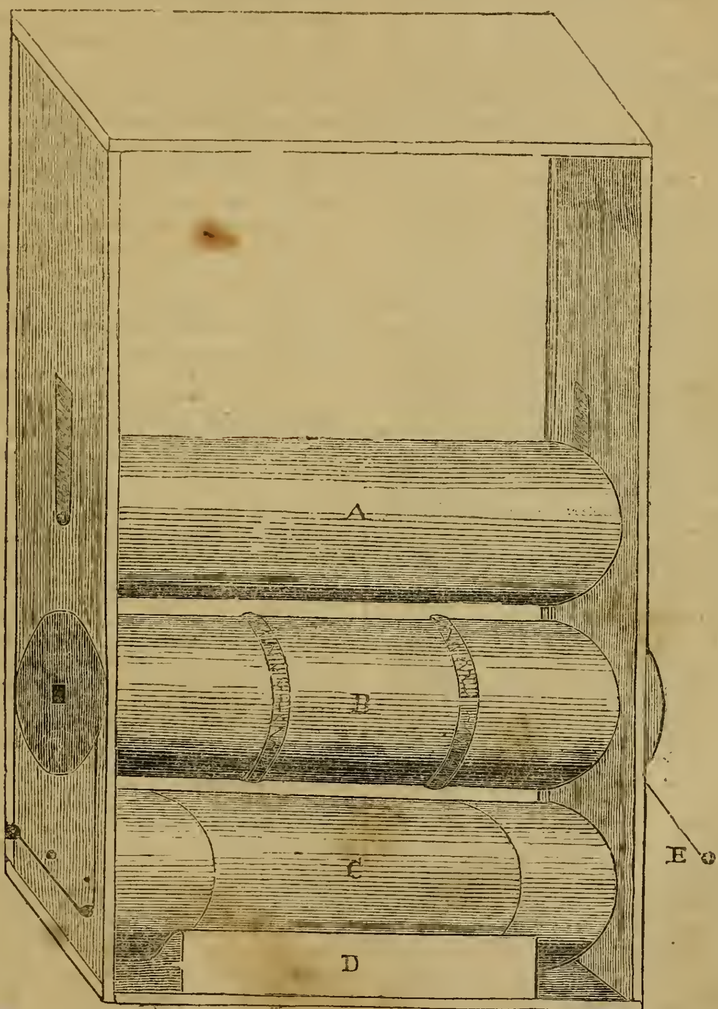
SCOTT'S MACHINE FOR STAMPING LETTERS.



 City Press, 1, Long Lane, Aldersgate Street · D. A. Doudney

PENNY POSTAGE.

(See Engraving, front page.)

[*No letter to be carried which is not written on stamped paper.*]

The paper to be stamped in the making, under the superintendence of the Excise. and a price set upon the said paper, sufficient to remunerate government for the carriage and delivery of the same, in the form of letters. The amount paid for stamping to be charged on the usual price of such paper by the manufacturer to the retailer, and by the retailer to the consumer. The object to be attained in this, being, that whilst it removes all cause for complaint of monopoly on the part of the manufacturer, brings the amount of the carriage of such letters through a more direct channel, than by the said amount being brought in by the deliverers of such letters; at the same time, saving a great sum of money, which would otherwise be expended for labour, and which would necessarily be incurred by the additional number of letters arising from the reduced postage. The deliverer, not having to receive postage for the letters he carries out for delivery, would, of course, be enabled to deliver *a considerable number more.* and that in *less time.*

Letters weighing no more than is allowed at the present time for single letters, to be carried as single letters; whilst those letters which are above the weight of a single letter, and not exceeding double such weight, to be charged *one penny extra*, either at the time of posting, or on the delivery of the said letters. Above this double weight, and up to a certain weight to be fixed by government, *twopence extra charge*, above which weight no letters should be carried.

The *stamp* for the paper, on which all letters to be sent by post must be written, I would propose to be that of the *royal arms*; the impression of which to be made on the opposite side of the paper to that on which a letter is commonly commenced; so that on folding the letter, the impression of the royal arms may be outside, and the address to be written over it.

Another proposition I would make, and which, I presume, would tend materially to the furtherance of the object now under consideration, is the manner of constructing the letter-boxes at the several receiving-houses under the operation of the penny post. The additional number of letters arising from the reduction of the postage, will not only require additional time for the stamping of such letters with the district mark, but will, in many instances, cause numerous mistakes and even delay. To remedy this inconvenience, I propose the letter-boxes to be thus constructed.

Description of Letter-box.

I propose that there should be fixed inside the letter-box, close to the mouth, three rollers (see engraving, A B C); these rollers are for the purpose of stamping the letters as they are put in; D is a box containing ink; the roller, C, which is to be covered with cloth for imbibing the ink, revolving in the box, will ink the type or stamp on the roller, B; so that, if the end of a letter be introduced between the rollers A and B, and the roller be set in motion, the letter must necessarily be drawn into the box, and be stamped at the same time: motion to be given to the roller by the pull at E; and after the letter has passed into the box, the spring, I, brings the rollers back into their former position, ready for another letter. Thus, every person stamps his own letters, which precludes all possibility of detention. Stamp 1, is the district mark; stamp 2, the date and time. As the type of the date stamp will require frequent altering; figures may easily be furnished with screws for receiving them on the roller.

W. Scott.

INVENTION OF GUNPOWDER.

Next to the invention of printing, there is no other that so much arrests our attention as that of gunpowder, which, by introducing artillery, and a new method of fortifying, attacking, and defending cities, wrought a complete change in the whole art and tactics of war. This invention comprises several discoveries, which it is necessary to distinguish from each other. 1. The discovery of nitre, the principal ingredient in gunpowder, and the cause of its detonation. 2. The mixture of nitre with sulphur and charcoal, which, properly speaking, forms the invention of gunpowder. 3. The application of powder to fire-works. 4. Its employment as an agent or propelling power for throwing stones, bullets, or other heavy and combustible bodies. 5. Its employment in springing mines and destroying fortifications.

All these discoveries belong to different epochs. The knowledge of saltpetre or nitre, and its explosive properties, called detonation, is very ancient. Most probably it was brought to us from the east (India or China), where saltpetre is found in a natural state of preparation. It is not less probable that the nations of the east were acquainted with the compo-

sition of gunpowder before the Europeans, and that it was the Arabs who first introduced the use of it into Europe. The celebrated Roger Bacon, an English monk or friar of the thirteenth century, was acquainted with the composition of gunpowder, and its employment in fireworks and public festivities; and according to all appearances, he obtained his information from the Arabic authors, who excelled in their skill of the chemical sciences. The employment of gunpowder in Europe as an agent for throwing balls and stones, is ascertained to have been about the commencement of the fourteenth century; and it was the Arabs who first availed themselves of its advantages in their wars against the Spaniards. From Spain, the use of gunpowder and artillery passed to France, and thence it gradually extended over the other states of Europe. As to the application of gunpowder to mines and the destruction of fortified works, it does not appear to have been in practice before the end of the fifteenth century. The introduction of bombs and mortars seems to have been of an earlier date (1467). The invention of these in Europe is attributed to Sigismund Pandolph Malatesta, Prince of Rimini; but in France they were not in use till about the reign of Louis the Thirteenth. Muskets and matchlocks began to be introduced early in the fifteenth century. They were without spring-locks till 1517, when for the first time muskets and pistols with spring-locks were manufactured at Nuremberg.

Several circumstances tended to check the progress of fire-arms and the improvement of artillery. Custom made most people prefer their ancient engines of war; the construction of cannon was but imperfect; the manufacture of gunpowder bad; and there was a very general aversion to the newly-invented arms, as contrary to humanity, and calculated to extinguish military bravery. Above all, the knights, whose science was rendered completely useless by the introduction of fire-arms, set themselves with all their might to oppose this invention.

From what we have just said, it is obvious that the common tradition, which ascribes the invention of gunpowder to a certain monk named Berthold Schwartz, merits no credit whatever. This tradition is founded on mere hearsay; and no writers agree as to the name, the country, or the circumstances of this pretended inventor, nor as to the time and place when he made this extraordinary discovery.—*Koch's Revolutions of Europe.*

EMIGRATION TO THE WEST.

"England, with all thy faults I love thee still," is a sentiment which recollection has often whispered to the emigrant in the bitterness of his disappointed hopes; and an intimate knowledge of other countries generally tends to make the impression indelible. The following sketches of society in western America, a fertile region, rapidly immerging into civilization, are from "A New Home—Who'll Follow? or, Glimpses of Western Life," by Mrs. Clavers, an actual settler:—

"*Helps in Michigan.*—Some of my dear theorizing friends in the civilized world had dissuaded me most earnestly from bringing a maid with me.

"'She would always be discontented and anxious to return; and you'll find plenty of good farmers' daughters ready to live with you for the sake of earning a little money.'

"Good souls! how little did they know of Michigan. I have since that day seen the interior of many a wretched dwelling, with almost literally nothing in it but a bed, a chest, and a table; children ragged to the last degree, and potatoes the only fare; but never yet saw I one where the daughter was willing to own herself obliged to live out at service. She would 'hire out' long enough to buy some article of dress perhaps, or 'because our folks have been sick, and want a little money to pay the doctor,' or for some such special reason; but never as a regular calling, or with an acknowledgment of inferior station.

"This state of things appalled me at first; but I have learned a better philosophy since. I find no difficulty now in getting such aid as I require, and but little in retaining it as long as I wish, though there is always a desire of making an occasional display of independence. Since living with one for wages is considered by common consent a favour, I take it as a favour; and this point once conceded, all goes well. Perhaps I have been peculiarly fortunate; but certainly, with one or two exceptions, I have little or nothing to complain of on this essential point of domestic comfort.

"To be sure, I had one damsel who crammed herself almost to suffocation with sweetmeats and other things which she esteemed very nice; and ate up her own pies and cake, to the exclusion of those for whom they were intended; who would put her head in at a door, with—'*Miss* (the Michigan word for *Mrs.*) Clavers, did you holler? I thought I *heered* a yell.'

"And another, who was highly offended because room was not made for her at table with guests from the city, and that her company was not requested for tea-visits. And this latter high-born damsel sent in from the kitchen a circumstantial account *in writing*, of the instances wherein she considered herself aggrieved; well written it was too, and expressed with much *naiveté*, and abundant respect. I answered it in the way which 'turneth away wrath.' Yet it was not long before this fiery spirit was aroused again, and I was forced to part with my country belle.

"*Popular Table Habits in Michigan.*—When Angeline left me, which she did after a few days, I was obliged to employ Mrs. Jennings to 'chore round,' to borrow her own expression; and as Mr. Clavers was absent much of the time, I had the full enjoyment of her delectable society, with that of her husband and two children, who often came to meals very sociably, and made themselves at home with small urgency on my part. The good lady's habits required strong green tea at least three times a-day; and between these three times she drank the remains of the tea from the spout of the teapot, saying, 'it tasted better so.' 'If she had'nt it,' she said, 'she had the 'sterics so that she wasn't able to do a chore.' And her habits were equally imperious in the matter of dipping with her own spoon or knife into every dish on the table. She would have made out nobly on kibaubs, for even that unwieldy morsel, a boiled ham, she grasped by the hock and cut off in mouthfuls with her knife, declining all aid from the carver, and saying coolly that she made out very well. It was in vain one offered her anything, she replied invariably with a dignified nod, 'I'll help myself, I thank ye. I never want no waitin' on.' And this reply is the universal one on such occasions, as I have since had vexatious occasion to observe.

"Let no one read with an incredulous shake of the head, but rather let my sketch of these peculiar habits of my neighbours be considered as a mere beginning, a shadow of what might be told. I might

"Amaze indeed
The very faculty of eyes and ears,'

but I forbear.

"If 'grandeur hear with a disdainful smile'—thinking it would be far better to starve than to eat under such circumstances, I can only say such was not my hungry view of the case; and that I often found rather amusing exercise for my ingenuity in contriving excuses and plans to get the old lady to enjoy her meals alone. To have offered her outright a separate table, though the board might groan with all the delicacies of the city, would have been to secure myself the unenviable privilege of doing my own 'chores,' at least till I could procure a 'help' from some distance beyond the reach of my friend Mrs. Jennings' tongue."

However desirable it may be to cultivate a friendly intercourse between neighbours in a country so thinly peopled as the back states of America, indiscreet familiarity may become a source of considerable annoyance and inconvenience, as appears by the following characteristic sketch:—

"'Mother wants your sifter; and she guesses you can let her have some sugar and tea, 'cause you've got plenty.'

"This excellent reason. 'cause you've got plenty,' is conclusive as to sharing with your neighbours. Whoever comes into Michigan with nothing, will be sure to better his condition; but woe to him that brings with him anything like an appearance of abundance, whether of money or mere household conveniences. To have them, and not be willing to share them in some sort with the whole community, is an unpardonable crime. You must lend your best horse to *qui que ce soit*, to go ten miles over hill and marsh, in the darkest night, for a doctor; or your team to travel twenty after a 'gal;' your wheel-barrows, your shovels, your utensils of all sorts, belong, not to yourself, but to the public, who do not think it necessary even to *ask* a loan, but to take it for granted. The two saddles and bridles of Montacute spend most of their time travelling from house to house a-manback; and I have actually known a stray martingale to be traced to four dwellings two miles apart, having been lent from one to another, without a word to the original proprietor, who sat waiting, not very patiently, to commence a journey.

"But the cream of the joke lies in the manner of the thing. It is so straightforward and honest, none of your hypocritical civility and servile gratitude. Your true republican, when he finds that you possess anything which would contribute to his convenience, walks in with 'Are you going to use your horses *o-day*?' If horses happen to be the thing he needs.

"'Yes, I shall probably want them.'

"'Oh, well; if you want 'em——I was thinking to get 'em to go up north a piece.'

"Or perhaps the desired article comes within the female department.

"'Mother wants to get some butter;

that 'ere butter you bought of Miss Barton this mornin.'

"And away goes your golden store, to be repaid perhaps with some cheesy, greasy stuff, brought in a dirty pail, with 'Here's your butter.'

"A girl came in to borrow a 'wash-dish,' 'because we've got company.' Presently she came back : 'Mother says you've forgot to send a towel.'

"'The pen and ink and a sheet o' paper and a wafer,' is no unusual request ; and when the pen is returned, you are generally informed that you sent 'an awful bad pen.'"

The following extracts show that men of talent and good company may be found by those who seek for it, even in this sequestered wilderness :—

"*The Michigan Doctor.*—A physician was sent for, and we expected of course some village Galen, who knew just enough to bleed and blister for all mortal ills. No such thing. A man of first-rate education, who had walked European hospitals, and who had mother-wit in abundance, to enable him to profit by his advantages! It is surprising how many such people one meets in Michigan. Some, indeed, we have been led to suppose, from some traits in their American history, might have 'left their country for their country's good ;' others appear to have forsaken the old world, either in consequence of some temporary disgust, or through romantic notions of the liberty to be enjoyed in this favoured land. I can at this moment call to mind several among our ten-mile neighbours, who can boast university honours, either European or American, and who are reading men even now. Yet one might pass any one of these gentlemen in the road without distinguishing between him and the Corydon who curries his horses, so complete is their outward tranformation."

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 62.)

There is a legend connected with Buckingham, which shows the unbounded credulity and superstition which prevailed in the "good old times" of the middle age ; it is the history of one St. Rumbald, who lived only three days, during which period he professed himself a Christian, and performed miracles ; he was born at King's Sutton, where his body rested for one year, after which it was kept two years at Brackley, and then deposited in the church at Buckingham, there to remain for ever, according to the tenor of his will. This story was so "incredibly attested," that it became a source of considerable profit to the town, by attracting numerous pilgrims, who made offerings at his shrine. *Stowe*, the magnificent seat of the Duke of Buckingham, is situated about two miles from the town of Buckingham ; when viewed from a distance, it presents the appearance of a vast grove, from which arise the summits of elegant towers, columns, obelisks, and temples. The grounds are very extensive, and although they have been celebrated for ages past amongst the finest specimens of ornamental gardens in this country, they have been greatly improved by the more refined taste of modern times. It was formerly the fashion to imitate the French in their formal stiffness, which made the plan of a garden appear more like a geometrical diagram, than an exhibition of the beauties of nature. The frequent and friendly communications which, during twenty-four years' peace, have existed between the two countries, have now, in some degree, corrected this vicious taste ; they occasionally allow nature to display her beauties unoppressed by the tyranny of art, and unmutilated by the pruner's knife ; such gardens they term *jardins à l Anglaise.* The love of pruning and cropping, is a striking characteristic of the French nation ; they are not satisfied with frightfully disfiguring the hedges and trees in their gardens, but the heads of their most revered functionaries, and the hind quarters of their dogs are periodically submitted to the same humiliating operation of cropping. Even the words they borrow from foreign languages, are clipped, spoiled, and "curtailed of their fair proportions" ; *gloria*, they reduce to *gloire*, and pronounce it *glwor* ; *Navarino* is pinched into *Navarin*, which they pronounce with an indescribably unpleasant articulation, something resembling the sound produced by holding one's nose, and endeavouring to pronounce the word *Ann*—in fact, the only good that ever resulted from this cropping propensity, is the abolition of pig-tails. But things are altered now ; in this country, at least, trees are no longer cut into pyramids and prisms, nor shrubs into squares and oblongs ; nature is cultivated, but not disguised ; secure from gallic shears, the privit unfolds its white blossoms, the bright passion flower reclines in Paradisean peace on the tender foliage of the fragrant jessamine, and the luxuriant vine curls with joy as it creeps through the cool branches of the pale tilia.

OF THE VALUE OF IRON,

AND THE NECESSITY OF ITS PRESENCE TO THE ADVANCEMENT OF CIVILIZATION.

Iron is one of the most useful metals with which man is acquainted, though not, perhaps, so valuable as some, when taken in equal proportions, yet when taken as a metal generally, is of much greater value than gold,—for the value of metal is according to the quantity procured, and of that disposed of.

We are liable to take up a nail or any other piece of iron, and throw it aside with the utmost disdain, but for one instant suppose, that iron ceased to be procured, you would then see, that every scrap of iron, whether nail, hoop, or of any other kind, would be sought after with the utmost eagerness. Or, in plainer terms, that all machinery, boilers, bridges, &c., were taken away, then what would society become? It would gradually sink into a state of demi-barbarism, you would then see the splendid edifices that are constantly being raised, fall to premature decay for the want of the first necessary tools; for the stone cannot be cut from the quarry without tools—cannot be fashioned without tools—cannot be raised to an eminence without tools—in all of which you will find iron more or less necessary.

Again, suppose that gold ceased to be found, or that gold was abstracted suddenly from society, how different would be the result; they could quickly find a substitute in silver, copper, zinc, or any other metal, which would, by affixing the stamp belonging to the sovereign, answer the purposes of commerce equally as well as gold. Or perhaps a better substitute might be found in paper, with which substitute I have nothing to do, my object being to show that iron, by its answering so many useful purposes, by being, in fact, an indispensable necessary, is not a metal to be regarded as insignificant, because it is common; for, as a clever man once observed, "*everything that is good, is common.*" Thus you see persons that are not in the habit of thinking, regard iron as almost superfluous, and gold as not only necessary, but above all price.

A little thinking on the subject will, however, soon convince any rational person, that to abstract iron from society, is to abstract civilization; but, on the other hand, to abstract gold, is only to form a vacuum that may easily be filled up.

W. J. Cuthbert.

[We cannot agree with our correspondent's "clever friend," that everything that is good is common." Gold is intrinsically a very good thing; and if we once possessed it in abundance, its "abstraction," and the necessity of supplying its place with corroding and poisonous metals, would be deemed a heavy blow upon humanity; good Burgundy, pines, and turtle, are things of unimpeachable goodness, but none of them very common —at least in this city, where they are most esteemed. True friendship, disinterested charity, and even the negative virtue of inert honesty, are all good things, and it is much to be lamented that they are not more "common." In fact, so far from vulgar error overrating the properties of gold, its real value is not generally appreciated; while the utility and importance of iron, are universally acknowledged, but many, like our correspondent, imagine that the discovery is their own, and that others do not entertain the same opinion. —Ed.]

THE CHEMIST.

ACIDS.

NO. VII.

Indigotic Acid.—To obtain it, nitric acid of specific gravity 1.285 must be diluted with rather more than its weight of water heated in a retort, and small portions of indigo in fine powder added, as long as sensible effervescence is produced, and a little water is added from time to time, to prevent the formation of carbazotic acid. The yellow liquid is separated whilst hot from the resinous matter, and by cooling, deposits crystals of the acid of indigo. This is boiled with oxide of lead filtered, and the salt present decomposed by sulphuric acid whilst hot; on cooling, it deposits yellowish white crystals of indigotic acid; these are to be separated, dissolved in hot water, neutralized by carbonate of baryta, the solution concentrated, and allowed to cool; yellow acicular crystals of a barytic salt are obtained, which, being washed with cold water, dissolved in hot water, and decomposed by sulphuric acid, give acicular crystals of indigotic acid quite pure. This acid is white, having the lustre of silk; it has a weak, acid, bitter taste, reddens litmus, dissolves in any quantity in boiling water and alcohol, forming colourless solutions, but requires 1000 parts of cold water for its solution. It is volatile, and being heated in a tube, fuses and sublimes without decomposition. In the air it burns with a bright flame, evolving much smoke. Nitric acid con-

verts it to carbuzotic acid. It gives a blood-red colour to solutions of the persalts of iron. It has the power to expel carbonic acid from carbonates. Its combinations with bases form salts called *indigotates*.

Laccic Acid.—To obtain it, the gum lac is digested in water, the solution evaporated, and the residue digested in alcohol. The alcoholic solution is evaporated to dryness, and its residue digested in ether. The evaporation of the etheric solution leaves a yellow matter, which being again dissolved in alcohol, and the solution mixed with water, deposits a little resin, and leaves laccic in solution, which, upon the addition of acetate of lead, gives a precipitate of laccate of lead ; the latter compound, by cautious decomposition by sulphuric acid, affords laccic acid. It is crystallizable, of a yellow colour, a sour taste, soluble in water, alcohol, and ether. Its salts are termed *laccates*.

Lithic, or *uric acid*, may be abundantly obtained, by digesting urinary calculi in caustic potassa, filtering the solution, and adding hydrochloric acid in excess, which causes a precipitate of lithic acid, which may be washed with warm water and dried. Lithic, or uric, thus obtained, is a grey powder, of scarcely any taste, and requiring, according to Dr. Henry, 1720 parts of water at 60°, and 1150 parts at 212° for solution. It reddens infusion of litmus. Its salts are called *urates* or *lithates*.

Malic acid was obtained by Scheele from the juice of apples in 1785. He obtained it by adding a solution of acetate of lead to the expressed juice of unripe apples, by which *malate of lead* was formed, and afterwards decomposed by sulphuric acid. It may also be obtained from the berries of the mountain ash as follows :—Express the juice of the ripe berries, and add a solution of acetate of lead; filter and wash the precipitate with cold water, then pour boiling water upon the filter, and allow it to pass through the precipitate into glass jars; after some hours, crystals are deposited, which are to be boiled with two-thirds their weight of sulphuric acid, specific gravity 1.090. The clear liquid is to be poured off, and while hot, a stream of sulphuretted hydrogen is to be passed through it to precipitate the remaining lead, the liquid is then filtered and boiled, so as to expel the sulphuretted hydrogen in a solution of the pure malic acid. When carefully prepared, it is a colourless liquid, very sour, and not susceptible of a regular crystallization, though when very carefully evaporated, it concretes into mammillary masses, showing traces of acicular crytsals. Nitric acid converts it into oxalic acid. Its salts are termed *malates*.

MISCELLANEA.

To produce Homogeneous Light.—An experiment, productive of much amusement, and at the same time illustrating the cause of colours, may be performed with homogeneous light. If a little spirits of wine, or some spirit, such as gin, be ignited in a dish, and a quantity of common table salt thrown on it, the lights in the room having been previously put out, every person present will assume an extraordinary colour; the hue of health will disappear from the cheeks, and the different articles of clothing will entirely change their colour. The cause of this phenomenon will be found in the circumstance, that the colour of bodies depends upon the rays of light being partly absorbed, and partly reflected. A ray of light can be shown to consist of seven prismatic colours, and different bodies possess the power of absorbing one or more of these colours, and reflecting all the rest; and the combination of the rays that are reflected, gives the particular colour to an object. Red-coloured bodies absorb all the rays, *except the red ray*; and this accordingly appears to be the colour of the body, and so on of all other colours. When homogeneous light is produced by the means above mentioned, as the articles of dress, and the faces of the company do not absorb all the yellow rays, but reflect a portion, the colour of everything is changed.—*Dalton's Book of Experiments.*

Porosity of Cotton.—Fill a common glass tumbler, or other vessel, completely with some spirituous liquor, so that a few drops more would cause it to overflow. This done, you would find no difficulty in introducing into the tumbler, so filled, a whole handful of raw cotton. Spirits answer better than water, for trying the experiment, from the rapidity with which they are absorbed by the cotton. Several theories were started by persons who tried the experiment; such as, that the filaments of cotton occupied the vacancies between the globules of water; or that by its capillary action the cotton subdivided the globules, and caused them to occupy a less space, &c.; to me, however, it appears to be accounted for more satisfactorily, by supposing the fluid to insinuate itself between the filaments of cotton, and thus permit the latter to occupy no more space than is due to their actual solidity.—*Journal of Franklin Institute.*

The Royal Exchange.—The New Royal Exchange, a place of congregation for merchants of the whole civilized world, in the first commercial city of ancient or modern times, a structure that will challenge criticism more frequently than any other in the metropolis, ought to be an object of the first importance. Expense, though an element in the question, should be a consideration subordinate to that which involves the taste of the country. The cost of a New Royal Exchange should not be stinted, like that of a gold or silver canister for the freedom of the city. A

grand building would be worth any money; a bad or inferior one may be worth nothing at all, or less than nothing. Of the eight designs selected by the three professional judges, No. 50, the best, and apparently so deemed by the judges, is set aside, because it is supposed that it will exceed 150,000*l.*, the sum to which the cost of the edifice is restricted; and consequently a design is to be selected from an inferior class. We are told that No. 50 might be erected for that sum; but if the contrary, surely it would be better to open a public subscription, in order to cover the excess, which, we are persuaded, would be speedily filled. The question which the judges should have had to determine, is simply which of the designs is decidedly the best? The rejection of a good plan for such a building, because it would cost a few thousands more than a bad one, will expose us justly to the contempt and scorn of other nations.—*Old England.*

A Cure for Rheumatism.—Rub dry flour of mustard upon the part affected, holding the part at the same time before a fire. Give it a good rubbing for some time, sufficient to bring out a rash on the skin, and relieve the pain. One rubbing is generally found sufficient. This is a Scotch old woman's recipe for rheumatism, and seldom fails in effecting a complete and very speedy cure.

Artificial Memory.—A humorous comment on such systems was made by a waiter at an hotel where Feinaigle dined, after having given his lecture on artificial memory. A few minutes after the professor left the table, the waiter entered with uplifted hands and eyes, exclaiming, "Well, I protest the memory man has forgotten his umbrella."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery-lane. Wednesday, Nov. 20, A. J. Mason, Esq., Sketches of the United States, Geographical, Political, and Moral. Friday, Nov. 22, B. R. Haydon, on the Muscles of the Lower Extremities; illustrated by the Living Model. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 21, H. W. Woolrych, Esq., on Provident Societies. At half-past eight.

St. Pancras Literary and Scientific Institution. Colosseum House, New-road. Friday, Nov. 22, Dr. N. Rogers, on the Mythology of the Ancients. At half-past eight.

QUERIES.

A "Subscriber from the Commencement" would feel greatly obliged if "Proportio," or any of your scientific correspondents would give a series of papers on the architecture of bridges. Also, from what substance the splendid light, commonly called the Bude light, is obtained, and its claims to general adoption in superseding gas. Likewise, a description of the mechanical contrivance by which the tolls are checked on Waterloo and other bridges.

Where can I obtain a book which contains the best instructions for carving and gilding? also upholstery work? I mean the cutting out of drapery. The best and most simple work on perspective drawing? A. C. R.

If there should be one amongst your numerous readers who has a magic lantern to dispose of, I should be glad if he would state size and price? I do not wish to have one larger than will admit sliders of four inches. A receipt to make French polish? GULIELMUS.

Where can I obtain a copy of Dr. Arnott's Elements of Physics? Perhaps some one of your readers has a copy to dispose of.

J. P. D.

TO CORRESPONDENTS.

W. P.—*The cause of grape shot spreading when fired from a cannon, is their being so much smaller than the bore of the cannon, that they are not guided in a straight line, being projected in various directions according to their position and the surface which receives the impulse. His second query may be answered by similar reasoning.*

E. P.—*Ventriloquism signifies an internal speaking, that is, an articulation without perceptible motion of the lips; it is no more to be acquired, than the fine tones of a singer, and depends upon a peculiarity of conformation in the organs and command of their action, which science has not hitherto been able to explain.*

Gulielmus *shall be answered in our next.*

W. J. Cuthbert.—"*Quot homines, tot sententiæ*" —*by obliging him (which we should be happy to were it in our power) we should displease a great number of our readers; our correspondent not only prescribes the particular subjects which are to occupy the columns of the "Mechanic," but he complains of our not anticipating the objects of his predilection. He says "you had very lately an extract headed 'Hints on Health,' which in my humble estimation was not apropos; for let me ask, what do I, as a student in chemistry, want to know about hints on health, or a respected friend of mine, a clever student in mechanics, care about health?' This requires no comment; we thank him for his intentions, which we presume to be good; and regret that we cannot, with propriety, comply with his desire, by confining this work to the specialities which he proposes.*

S. Walter's *communication has been unavoidably delayed, but shall appear, if possible, next week.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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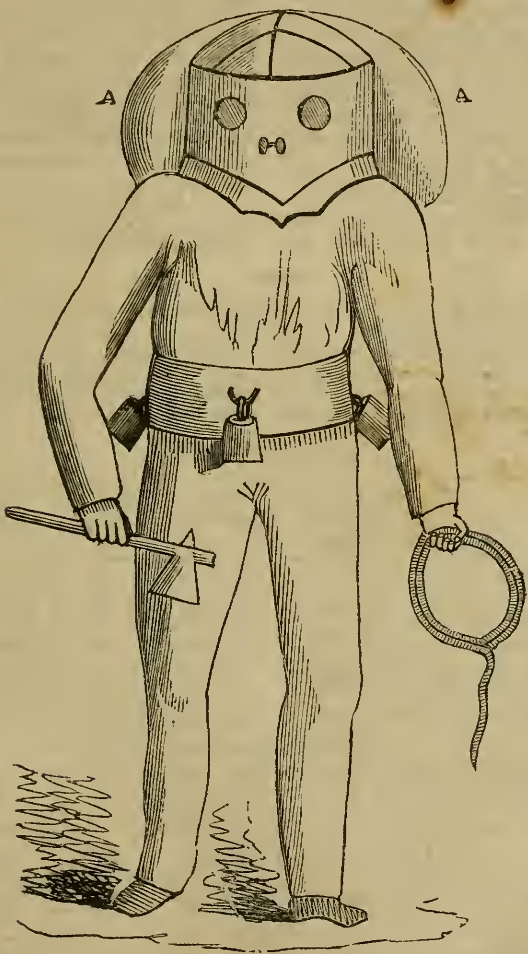
PIESSE'S APPARATUS FOR REMAINING UNDER WATER.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PIESSE'S APPARATUS FOR REMAINING UNDER WATER.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—I herewith send you a drawing of an apparatus for remaining under water a short time, without having any communication from above. The apparatus is the same as usual, with this exception, the individual is supplied with air from a copper bag at his back, which contains condensed air. The mode of supplying the diver with a continued stream of air, and for it to enter the helmet at the same velocity throughout the time he is under water, I do not think proper to give the public, without some slight remuneration from some person or other, although, Mr. Editor, I would give it to *you* with pleasure, as I think it an honour due to you from all individuals occupying your valuable pages. The bag, as I term it, can be made to hold about twenty gallons under pressure; and as we require about one gallon every minute, I should be able to remain under water a quarter of an hour with ease. The admixture of one-thirtieth more of oxygen with the air would, I think, counteract the effect of the cold experienced by persons in this situation, as it would cause the circulation to be carried on rather faster. The benefit derived from this apparatus over the old one is, 1st, its comparative cheapness, there being nothing more required to condense the air than a common piston of a condensing pump; 2nd, its use to the Humane Society for a man to wear when in search for a body, instead of drags, which prove very often useless; 3rd, there are many lakes, canals, &c., with treasures at their bottoms, which might be recovered by this means, and at so trifling an expense; only one man being required, and no pumps or any other apparatus whatsoever; 4th, its being able to be used in very quick time, &c., &c.

I am, Sir, yours truly,

Juvenile Entertainer.

241, Oxford-street.

MR. HILL'S REPORT ON THE FRENCH POSTAGE.

This document, as might be expected, contains little information applicable to the new system of postage *promised* in this country; there are, however, some passages which will be read with interest.

"The following is a comparative statement of the receipts and expenditure of the British and French Post-offices for the years 1821 and 1837 :—

British Office.

	Gross Receipts, exclusive of Returns.	Expenditure.	Per Centage.	Net Receipts.
Year.	£	£	£	£
1821	2,038,706	645,241	30	1,393,465
1837	2,339,738	669,940	27	1,669,798
Increase	310,032	24,699		276,333

French Office.

Year.	£	£	£	£
1821	955,708	474,462	50	481,246
1837	1,615,294	847,348	52	767,946
Increase	659,586	372,886		286,700

There appears to have been no material change in the rates of charge in either country during the period in question.

From these statements it appears, that the gross Post-office revenue of France is about two-thirds of that of England ; the

expenses about 20 per cent more, and the net revenue nearly one-half. But in comparing the expenses, it will be necessary to bear in mind the greater extent of France, and the fact that the expenses for that country include the whole cost of the mail-coaches. On the other hand, the cheapness of labour in France, as compared with England, must also be recollected. A large portion of the increase, both in the receipts and the expenditure of the French Post-office, is owing to the establishment of the 'Poste Rural,' which took place in 1836."

"*Sorting.*—In consequence of the large number of post-towns on some of the roads (the Toulouse road, for instance, has 223), the outward letters are for the most part sorted thrice; namely, first for roads; secondly, for portions of the road (called first side, second side, &c., according to the situation of the boxes in the sorting rooms); and, thirdly, for towns. (With us, the intermediate sorting for 'sides' is unnecessary). In this process, however, much time is saved, by selecting in an early stage of the business all the letters for certain large towns, as is done in the London office also.

In Paris the letters, as they are assorted, are thrown into boxes; in London they are placed on a table so as to keep them 'faced,' that is arranged with the addresses uppermost, with a view to facilitate the after operations; in each office the sorters consider their own plan the best.

As respects the sorting of inward letters, there are some peculiarities in the practice of the Paris office. The letters from the departments, those of the Banlieue, and those of the Petite Poste, are first sorted for districts (nine in number), in three distinct offices. They are then all carried into the letter-carriers' offices, and the letters for each district are thrown on a separate table, round which the letter carriers of the district (generally about twenty in number) are seated, each having before him a portion of the table, divided off by a low partition, a space for the unassorted letters being left in the middle. Each man takes a handful of letters from the heap in the middle of the table, and deals them out like a pack of cards, throwing those which belong to his own walk into his own compartment of the table, and the remainder into those compartments to which they respectively belong. As about twenty men are thus employed at the same time, and at the same table, the letters cross one another in all directions, producing a very curious appearance. The process was gone through with great rapidity, and by long practice each man appeared to have learnt to aim pretty accurately at each compartment of the table, without taking his eyes off the letters in his hands. No doubt many mistakes would arise; occasionally two letters would meet, and arrest each other midway, but all errors were rectified in the final process, which consisted in each man's arranging his own letters in the proper order for delivery. I am not prepared to express any opinion on the comparative advantages of this plan and of that practised in the London office."

"*Public Notifications.*—At each Post-office in Paris a board is placed outside, near the letter-box, on which is the following inscription:—

LETTER BOX.

Letters for Paris
put in the Box now, will be
delivered

(A)

from $\boxed{\text{two to four.}}$

General Post
and Foreign Letters
put in (B) the Box now,

(A)

will leave $\boxed{\text{to day at six.}}$ in the evening.

N.B. On Sundays and holidays, after the removal of the box, corresponding with the delivery from 4 to 6, country letters will not be sent till the following day.

[A, A). Holes in the tablet, through which the wheel behind is seen.

(B). Key-hole.

(The inscription is of course in French; but we translate it for the convenience of our readers.)

The hours are inscribed on a wheel, which, by means of a key applied to the

centre, is moved on every time the letters are despatched. This form of notification might, I think, be advantageously employed in England."

The most important improvements which have recently taken place in the French Post-office, being imitations of the English system, it is unnecessary to describe them here.

EFFECT OF RAILWAYS ON LONDON.

Among the various problems of minor importance which have arisen from a consideration of the general results of railroads, it is constantly asked—*in what manner will they affect our metropolis?* There are many who argue that the facility with which people who are now immured in London will be enabled to get into the country, must have the effect of diminishing the population of the metropolis. We must, however, acknowledge that we differ from this opinion.

As travelling has been found invariably to increase in proportion to the facility with which it can be effected, it would follow, that so many railroads, converging upon London as a centre, must, at all events, daily bring thither large crowds of passengers, besides which, the railroads would import provisions in such quantities, that their price would inevitably fall. On looking at those statistical tables which show the prices of provisions all over the United Kingdom, it is very curious to observe with what exactness these prices decline on the different roads, in proportion to the distance from the capital —so that, if a man with these tables in his pocket were to fall from the clouds upon any given road, by simply asking the first person he met to tell him the price of butter, for instance, and by then looking at his tables, he would be able to determine very nearly his precise distance from the metropolis. Now, when London, instead of being supplied with expensive milk, fruits, and vegetables, produced on land and gardens of an exorbitant rent, can be readily furnished with these articles from a distance—when bullocks, instead of being driven at great expense, "larding the lean earth as they proceed," can be killed 100 or 200 miles off, and be thus despatched to, instead of in, the metropolis—and when all sorts of provisions can be forwarded thither with equal facility, it must, we conceive, follow that the prices of these commodities will be more equally adjusted throughout the country than they hitherto have been. London must thus become a cheaper residence, and we think there can be no doubt that, in proportion as the objections to living in it are removed, its population must increase. When a powder magazine by exploding creates a vacuum in the atmosphere, the windows of the adjacent houses are not, as most people would be led to expect, forced inwards, but the air within their rooms breaks the glass outwards, in rushing to restore the equilibrium of the atmosphere. On similar principles, the population of the country will, we conceive, rush towards the London markets, whenever by any commercial convulsion the price of provisions is suddenly lowered; and thus will the effect of the railroads upon the metropolis be, we conceive, centripetal, and not, as has been supposed by many, centrifugal.

It is true that the twenty minutes, thirty minutes, and sixty minutes citymen (we mean those gentlemen whose affluent fortunes allow them now to live those periods of time from the metropolis, will, instead of residing at Hackney, Putney, and other such retreats, rush away to Maidenhead, Watford, and places from ten to thirty miles from London; but the number of these will not only comparatively be few, but the houses they abandon, falling in rent, will attract a new description of men—besides which, as where a man's treasure is, there is generally his heart, so, wherever these gentlemen may sleep, they will still *bonâ fide* be actual inhabitants of the metropolis, it may be justly said they will carry it with them, and that the real limits of London will become, as indeed they now are, that radius to which its population can at night conveniently retire to their pillows.—*Sir Francis Head.*

REVIEWS.

The School Boy's Companion; or, Treasury of Amusement. By T. Kentish. London: W. Harris, 46, St. John-street, Clerkenwell.

This little volume, though, as the title announces, intended for the amusement of youth, contains much information which will not be despised by "children of a larger growth." The happy idea has occurred to the author, of giving a list of the various articles required in the different constructions and experiments mentioned in the work, with the prices usually charged, and the shops at which they may be procured. We subjoin some extracts, which we trust will be found interesting to many of our readers:—

"*To make Ginger Beer.*—Sugar, half a pound; cream of tartar, half an ounce; ginger, one ounce; boiling water, one gallon. Ferment 24 hours. Bottle.

Another.—Sugar, three pounds; ginger, two ounces; cream of tartar, one ounce; four lemons sliced, boiling water, four gallons. Ferment four days, with a pint and a half of yeast. Bottle.

Ink.—1 Sulphate of iron; 1 logwood; 1 gum Arabic; 3 nut galls; 20 water; 20 vinegar.

Red Ink.—1 Cochineal, 8 gum Arabic, 16 ground Brazil wood, 16 alum, 160 sour ale.

Blacking.—1 oz. sulphate of iron, 1 oz. sweet oil, 1 oz. sulphuric acid, $\frac{1}{4}$ lb. ivory black, $\frac{1}{4}$ lb. treacle, 1 pint vinegar. Dissolve the sulphate first, in a little of the vinegar boiled, and add the sulphuric acid last.

French Polish.—$\frac{3}{4}$ oz. seed lac, 3 drams gum juniper, 2 drams gum mastic, 4 oz. spirit of wine. Mix, and set in a warm place.

To Crystallize Tin.—1 spoonful muriatic acid, 1 nitric acid, 8 water. Mix. Warm a piece of block tin over the fire, and rub it with a cloth dipped into the mixture. Ornament with coloured varnish."

The greater portion of the volume is devoted to subjects which belong exclusively to boy's play; but while we recommend our young friends to explore this mine of entertainment, we feel it our duty to caution them against the great danger attending the preparation of different kinds of fireworks, and most especially the fulminating powders, with which it would be better for them not to meddle at all.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 83.)

THE gardens of Stowe are ornamented with a profusion of beautiful models of ancient and modern art. One mile from the south front of the house, is a Corinthian arch sixty feet high, and sixty feet wide, erected on an eminence. The principal approach is through this gate-way, which commands a splendid view of the mansion, gardens, and various ornamental buildings. At a short distance from the arch is one of the entrances to the gardens, which contain about four hundred acres, diversified with woods and lakes, and presenting a variety of contrasting scenery, managed with admirable taste and skill. The principal objects of attraction are the following:—

The Ionic pavilions, near the entrance, where the water spreads out to a considerable lake, and then divides itself into two branches, and retires through beautiful valleys to the north and east.

The Temple of Venus, a square building, decorated with Ionic columns, connected by semicircular arcades to a pavilion at each extremity.

The Queen's Statue is situated on the side of a hill, and enveloped with trees. The figure of Queen Caroline is supported by four Ionic columns.

Baycott Pavilion, designed by Vanburgh, and principal entrance gate designed by Kent.

Temple of Bacchus, from Vanburgh, whence the view is particularly beautiful.

The Rotunda is situated in the centre of a spacious lawn, surrounded with trees; it is supported by ten Ionic columns, and contains in the centre, a statue of Bacchus.

The Elysium Fields contain the figures of heroes, poets, and philosophers, and include some of the most delightful views in the whole domain—may its occupiers ever justify the appellation by making it the abode of the good.

A Doric Arch, decorated with statues of Apollo and the Muses, leads from the Parterre into the Elysium Fields. This building is situated on an eminence, and inscribed to her Royal Highness, Princess Sophia Amelia, who visited Stowe, in the year 1766. Through this arch is seen the Palladian bridge and a castellated lodge on the opposite hill. On the right is the *Temple of Friendship,* and on the left are the temples of *Ancient Virtue,* and of *British Worthies.* The Temple of Ancient Virtue is a circular building of the Ionic order, situated in the midst of a wood. The dome is supported by sixteen columns, and the inside is decorated with four statues by Sheemaker. The Temple of British Worthies is a semicircular building, erected on the banks of the upper lake, after a design by Kent. It contains the busts of the following celebrated men, with appropriate inscriptions:—Alexander Pope, Sir Thomas Gresham, Ignatius Jones, John Milton, William Shakespeare, John Locke, Sir Isaac Newton, Sir Francis Bacon, Lord Verulam, King Alfred, Edward Prince of Wales, Queen Elizabeth, King William III., Sir Walter Raleigh, Sir Francis Drake, John Hampden, Sir John Barnard.

The Grotto is situated in a romantic dell, and composed of broken stones, pebbles, flints, shells, spars, and other materials. It consists of two caverns: from the lower-

most, the water flows into a rivulet ornamented with several small islands, and overshadowed by a variety of intersecting branches. Fossils, petrifactions, and spars, constitute the inside of the grotto, which is also decorated with two white marble basons, and a statue of Venus, apparently rising from the bath. A mirror placed behind this statue reflects the whole scene with considerable effect. In this romantic spot, George the Fourth dined when he visited Stowe.

The Temple of Concord and Victory is a large handsome building, of an oblong shape, decorated with twenty-eight fluted Ionic columns. This is acknowledged to be one of the most chaste and elegant ornamented structures in the kingdom; and as long as it continues to exist, the architect will need no other monument to record his taste and judgment. It was originally designed by Kent, but the internal decorations were completed in 1763 by Signor Borra, when the late Lord Temple gave it the appellation which it now bears, to perpetuate the remembrance of the peace then ratified at Fontaniebleau.

Lord Cobham's Pillar, on the other side of the valley, is 115 feet high, surmounted with a statue of his Lordship. It was originally designed by Gibbs, but has been altered by Valdré, who enlarged the pedestal, in order to receive four lions, that are now placed on the angles. The view from the top will repay the trouble of ascending. Near this column is a beautiful temple, called

The Queen's Building, originally designed by Kent, since whose time it has been augmented by a Corinthian portico, leading to a large elegant room, decorated with scagliola columns and pilasters, supporting a trunk ceiling, executed from the design of "the Temple of the Sun and Moon" at Rome. On the opposite side of a deep valley, is the most picturesque and curious building in the gardens, denominated

The Gothic Temple. This is a triangular building, with a pentagonal tower at each corner; one of which rises to the height of seventy feet, and terminates with battlements and pinnacles; the others are surmounted with domes. The whole is constructed with a brownish stone, and being seated on the brow of a hill, forms an interesting object from many parts of the gardens. The inside is richly ornamented with light eolumns, and various pointed arches: and the windows are glazed with a fine collection of old painted glass, on which a variety of sacred subjects and armorial bearings are represented. The principal room is circular; and its dome is ornamented with the descents and intermarriages of the Temple family, in a regular series of armorial bearings, from the Saxon Earls of Leicester, to the late Lord Viscount Cobham, and Hester, Countess of Temple, his sister and heiress. Two of the towers contain small circular chapels, decorated with painted glass, of the armorial bearings of different families. In the other tower is the stair-case leading to the gallery on the second story, where there are two other small chapels, with the arms of the Saxon heptarchy. This stair-case leads to the top of the highest tower, where a very extensive view is obtained, comprehending the greater part of the domain. In a woody recess, near the temple, are some good statues by Rysbrack, of the seven Saxon deities who gave names to the days of the week; on each of which is a Saxon inscription. At the bottom of a gentle declivity is

The Palladian Bridge, so denominated from being built after a design by the celebrated Italian architect, Palladio of Vicenza. It has one large, and four small arches, and is decorated with a balustrade on each side, and sixteen Ionic columns supporting a roof. This bridge is built of the same shape and dimensions as that at Wilton in Wiltshire, the seat of Lord Pembroke. Near it is

The Temple of Friendship, built in the Tuscan style of architecture, and ornamented with a portico, supported by four columns. The inside is furnished with busts of the following celebrated and noble personages:—Frederic, Prince of Wales, Earl Chesterfield, Earl Westmorland, Earl Marchmont, Lord Cobham, Lord Gower, Lord Bathurst, Richard Grenville, late Earl Temple, William Pitt, late Earl of Chatham, George, late Lord Lyttleton.

The Pebble Alcove and Congreve's Monument, executed from a design by Kent. This is decorated with emblematic devices, expressive of the poet's peculiar bent of genius in dramatic compositions. On the top sits a monkey viewing himself in a glass.

Such are the principal objects in these celebrated gardens, where, as Walpole observes, "the rich landscapes occasioned by the multiplicity of temples and obelisks, and the various pictures that present themselves as we change our situation, occasion both surprise and pleasure, sometimes recalling Alban's landscapes to our mind; and oftener to our fancy, the idolatrous and luxurious vales of Daphne and Tempe."

THE CHEMIST.

ACIDS.

NO. VII.

Manganesic acid may be obtained as follows:—Two parts of nitrate of baryta, are mixed with one of peroxide of manganese, and exposed to a red heat; a green mass is obtained, which is to be reduced to fine powder, mixed with twenty-five parts of water, and a stream of carbonic acid passed through the mixture, which is kept constantly stirred, carbonate of baryta is formed, and a deep violet-coloured solution of manganesic acid. When the diffused powder has lost its green colour, the fluid is poured off and boiled for a quarter of an hour, to expel excess of carbonic acid, during which, a portion of carbonate of baryta and peroxide of manganese are precipitated. The clear fluid is boiled down to one-fourth its bulk, again left to become clear, and ultimately evaporated to a small bulk; during this evaporation, oxide of manganese is again separated, in consequence of the decomposition of part of the acid; but the residuary solution forms acicular crystals of hydrated manganesic acid on cooling. All attempts to deprive this acid of water have failed. Its solution has a peculiar astringent taste, possesses considerable bleaching powers, and exhibits a violet colour by transmitted light, but appears of a carmine red by reflected light. It is decomposed by boiling, especially when diluted, and also by exposure to the sun's rays. It forms salts termed *manganesates*.

Margaritic acid may be obtained as follows:—When soap, composed of hog's lard and potassa, is put into water, a portion only is dissolved, the remainder consists of white scales, composed of the alkali united to a peculiar acid, called by Bevreul, from its pearly appearance, *margaritic* or *margaric acid*, and separable from the above combination by hydrochloric acid. It is insoluble in water, tasteless, fusible at 134°, and crystallizes on cooling in brilliant white needles. It is soluble in alcohol. Its compounds are termed *margarates*.

Oleic Acid.—The portion of the hog's lard soluble in water (mentioned in the above preparation), consists of another peculiar substance united to potassa, which is called *oleic acid*. It may be obtained from its solution by tartaric acid, which causes it to separate in the form of an oily matter, that is to be again united to potassa, and separated as before. This substance solidifies at about 40°, and it forms compounds called *oleates*.

Oxalic acid is found in some fruits, and in considerable quantity in the juice of the oxalis acetorilla, or wood sorrel, and in the varieties of rhubarb. It is most readily procured by the action of nitric acid upon sugar, and hence it has been termed *acid of sugar*. It may be obtained by introducing into a retort four ounces of nitric acid, diluted with two of water, and one ounce of white sugar; nitric oxide gas is copiously evolved, and when the sugar has dissolved, about one-third of the acid may be distilled over; the contents of the retort are then emptied into a shallow vessel, and in the course of two or three days an abundant crop of white crystals are obtained, and upon farther evaporation of the mother liquor, a second portion is deposited. The whole crystalline produce is to be again dissolved in water and recrystallized, by which the pure acid is obtained. In this way sugar yields rather more than half its weight of oxalic acid. Oxalic acid thus procured, is in the form of four-sided prisms, transparent, and of a very acid taste. The crystals dissolve in two parts of water at 60°. Its compounds are termed *oxalates*.

Phosphorous Acid.—If phosphorous and corrosive sublimate (bichloride of mercury) be exposed to an elevated temperature, a liquid called protochloride of phosphorus is formed; if water be added to this, it resolves it into muriatic and phosphorous acids. With a moderate heat the former is expelled, and the latter remains. It can also be procured by burning phosphorous in a tube, with very limited access of air and caution as to temperature; it may be easily collected in the form of a white volatile powder, which, when exposed to air, becomes hot, inflames, and burns into phosphoric acid. It rapidly dissolves in water, has a sour taste, reddens vegetable blues, and combines with certain of the solifiable bases to form salts called *phosphites*.

To prevent danger from leaving a Poker in the Fire.—Immediately above that square part of the poker, by blacksmiths called the *bit*, let a small cross of iron be welded, about an inch and a half each way. The good consequences of this simple contrivance will be,—1st, if the poker, by the fire giving way, should slip out, it will probably catch on the edge of the fender; 2d, if it should not, it cannot injure the hearth or carpet, as the hot part of the poker will be borne up some inches; and, 3rd, the poker cannot be run into the fire farther than the bit, which, in regard to a polished poker, is also of some consequence.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Nov. 28, G. A. F. Wilks, M. D., Lecturer at the North London and Westminster Hospital Schools of Medicine, on Botany. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Nov. 29, Dr. N. Rogers, on the Mythology of the Ancients (in conclusion. At half-past eight.

QUERIES.

Will your talented correspondent "Propoitio," or any other of your intelligent correspondents, be kind enough to give an opinion on the present appearance of the skew bridge, which crosses Joiner-street, belonging to the Greenwich railway? The rent in the arch extends from the spring on one side to the foot-path on the other.

W. R.

A composition which will prevent leather from cracking, and where I can purchase a small quantity? Also, how I can make a hydrometer, such as we see in the shops made of card-board, in various shapes; such as a monk whose cowl is raised over his head in wet weather, or a house, from which a man or woman comes out, the one in wet, and the other in fine weather. I believe it is cat-gut which causes the motion by shrinking; if so, how to apply the cat-gut, &c.?

A Reader from the first.

How engineers calculate the speed of a paddle-wheel? Do they calculate from the speed of the extreme outer edge of the paddle-board, or do they take the speed from any other part of the paddle.board?

A. P. F.

ANSWERS TO QUERIES.

Having read of frequent inquiries for models of steam-engines in your magazine, I beg to inform those of your correspondents who may want such, that I have a cylinder and slide to dispose of, of peculiar construction; the dimensions of which are—height, 8 inches, with 7-inch stroke, and made for a diameter of $2\frac{1}{2}$ inches. The whole of it is made substantially of white metal, and has a very handsome appearance. May be viewed at No. 5, Richmond-place, East-street, Walworth.

Cicero.

To make Carmine.—Four ounces of finely-powdered cochineal are to be poured into four or six quarts of rain or distilled water that has been boiled in a pewter kettle, and boiled with it for six minutes (some advise to add during the boiling two drachms of pulverised crystal of tartar), eight scruples of rock alum in powder, and then to be added, and the whole kept upon the fire one minute longer. As soon as the gross powder has subsided to the bottom, and the decoction has become clear, the latter is to be carefully decantered into large glasses covered over, and kept undisturbed till a fine powder is observed to have settled at the bottom; the superabundant liquor is then to be poured off from this powder, and the powder gradually dried; this powder is carmine. From the decantered liquor, which still contains much colour, the rest of the colour may be separated by a solution of tin, which yields a carmine little inferior to the other.

A Juvenile Entertainer.

Another Method.—Twenty ounces of cochineal is to be boiled in two gallons of water, adding sixty grains of alum; then pass it through a fine cloth to remove the cochineal; heat the liquor again, and pour into it a saturated solution of muriate of tin until the carmine is precipitated.

To make Blue Ink.—"V. T. L." Take of ferrocyanide of potassium, quarter of an ounce; oxalic acid, quarter of an ounce; dissolve these in half a pint of rain water; then add half an ounce of the tincture of sesqui-chloride of iron; stir well together, and dissolve half an ounce of gum Arabic in the solution. This does not change colour, neither have the acids any effect upon it.

J. Mitchell.

To Melt Brass in small quantity.—I would recommend "G. G." in your queries to purchase the book you have quoted, "Chemistry no Mystery," and read pages 2 and 200, and he will see how to melt brass by means of a common candle.

To take Stains out of Crimson Silk, cannot be done without discharging the colour *in toto*.

To Prepare Paper for Painting on.—"T. H." This may be done by means of a weak solution of isinglass being laid over the surface, say two or three coats, allowing each to dry before the other is applied; and an excellent varnish for the same, after painting, may be made by mixing equal parts of Canada balsam and spirits of turpentine.

Carbonic Acid Gas may be made with chalk or whitening and oil of vitriol. W Bartlett.

Chelsea.

TO CORRESPONDENTS.

J. Mitchell.—*We shall be glad to receive any communication from the talented writer of the papers on chemistry.*

J. A. J. *shall be attended to.*

S. H. H.—*The weight of a person is not affected by any peculiar state of respiration; the experiment must have been misunderstood, and should be classed with the notion, that a fish put into a pail of water will not increase the whole weight, or that a person is not heavier after taking his dinner, and others of a similar kind; they have no foundation in truth.*

P. P. *will see, in our next, some observations on the subject of the proposed fourpenny postage; we look upon that measure with much suspicion, but trust that the energy of the nation will ultimately cause the intentions of the legislature to be carried into effect.*

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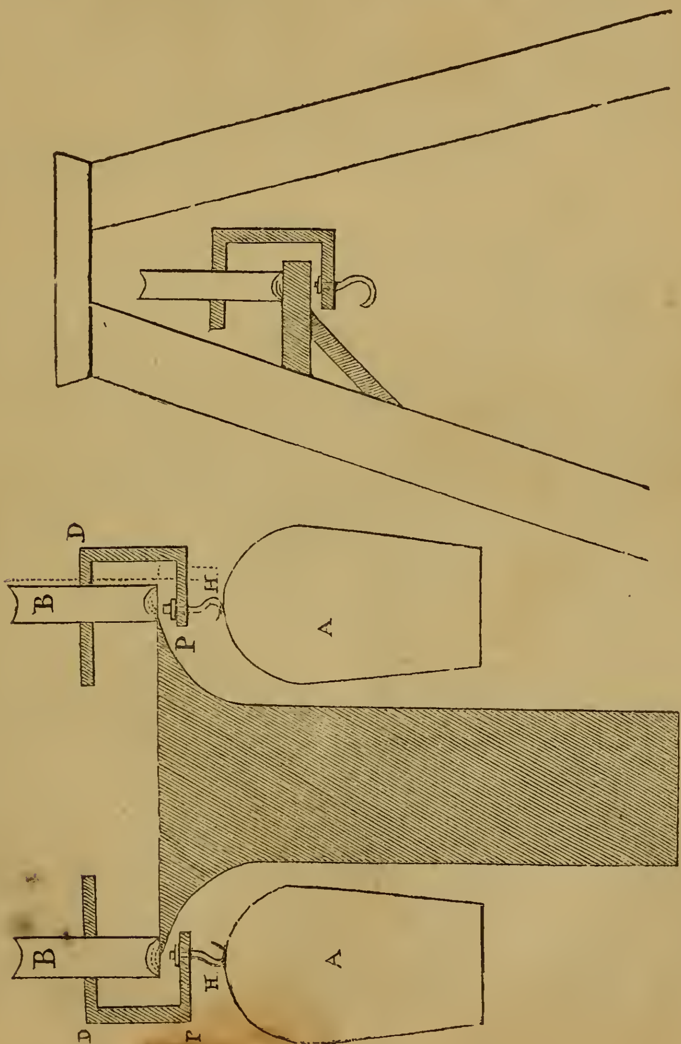
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 63, NEW SERIES. | SATURDAY, NOV. 30, 1839. PRICE ONE PENNY. | No. 184, OLD SERIES.

JONES'S UNAROTA RAILWAY AND RAILWAY CARRIAGE.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

JONES'S RAILWAY.

To the Editor of the Mechanic and Chemist.

(See engraving, front page.)

SIR,—I herewith send you a sketch of what might perhaps be styled a novel invention, being nothing more or less than a railway carriage upon one rail and one wheel; perhaps some of your ingenious readers may be able to turn the suggestion to some good practical account.

Fig. 1, A A, are two separate and independent carriages; B B, their wheels, which revolve around the axles, D D, upon the rails underneath; Fig. 2, is the same principle applied in another manner for crossing deep valleys, marshes, &c. By fixing a spur wheel upon B, and another upon the arm, P, it could be easily driven by an engine in the carriage. Any farther remarks are unnecessary, the drawing will be easily understood upon inspection. I remain yours, &c.,

WM. JONES.

MR. CHARLES GREEN'S INTENDED VOYAGE ACROSS THE ATLANTIC IN A BALLOON.

THE aerostatic art has for many years past attracted the attention of scientific men, but little or no progress has been made towards the application of balloons to any purpose of practical utility. Most writers on this subject have fallen into the error of directing their researches towards objects which can never be attained, or which, if successfully achieved, would in no degree advance the solution of the great problem, of rendering the science of aerostation serviceable to mankind. Of the first description is the attempt to guide a balloon, by means of sails or wings, in any required direction; now it is clear that in a uniform current of wind, no construction of sails on the principle of navigation, can alter the motion of the machine, since it moves with the same velocity as the wind, and consequently receives no impulse, but goes on with the force of its own inertia, which continues till external impediments destroy it. There are also insurmountable obstacles to the successful application of wings in imitation of the flying of birds, or the swimming of fish; the power of the wind acting on so large a surface as that of a balloon must necessarily be, far exceeds that of any machine at present known, within the required limits of size and weight; and even admitting that sufficient power could be obtained, the violent agitation and strain upon the machine, would render it practically impossible to employ it. Much time and labour, and even life, have been expended in the construction of parachutes —machines which must ever be attended with considerable danger, and even in their most perfect form, would be utterly useless, since the same object may be attained by a separate balloon of small dimensions, which might be detached should it be required to send down one or more of the passengers before the descent of the principal machine.

Mr. Green's project of crossing the Atlantic, will no doubt create much interest throughout the scientific world; and should he succeed, as we most fervently hope he will, he may claim the honour of making the first step towards the useful application of ballooning.

Mr. C. Green has authorised the following statement of the grounds upon which he founds his assertion of the possibility of making a journey in a balloon from New York, across the Atlantic, to Europe. He states that balloons inflated with carburetted hydrogen, or common coal gas, will retain the fluid unimpaired in its buoyancy, and very slightly diminished in quantity, for a great length of time; whilst, on the contrary, the pure hydrogen is so subtle a gas, and capable of so great a degree of tenuity, as to escape through the imperceptible pores of the silk, whether prepared in the ordinary manner, or by means of dissolved India-rubber. These facts are the result of observations made during 275 ascents; on many of these occasions, a smaller balloon has been filled at a neighbouring gas-works, and has been brought a distance of five or six miles to fill that in which he intended to ascend, retaining, in many instances, its contents nearly the same in quantity and quality for nearly a week. The aeronaut has travelled 2,900 miles with the same supply of gas, and could have continued its use for three months if necessary. As to making the voyage from America to Europe, Mr. Green states its possibility from the following facts:—On all occasions in which the balloons in which he or other aeronauts have gained an altitude beyond the lower current of air, or land breeze, they found one uniform current of air coming from the Atlantic, and blowing west, north-west, or west by north, whilst the under winds, from different causes, were blowing from points completely at variance with the above; the ascent of the machine into these upper currents is perfectly easy, and the same altitude may be kept for an indefinite time with equal facility.

in 1836, Mr. Green made a proposition at Paris to cross the Atlantic in a balloon, when he received a letter from Admiral Sir Sidney Smith, confirming his observations as to the directions of the upper currents, and in which that gallant officer states his conviction of the safety of the proposed undertaking, and his readiness to accompany the aeronaut from New York to Europe in his balloon. It must be kept in mind, that a balloon is not borne along as is a ship by the force of the wind, having to overcome the impediment interposed by passing through a denser element like the water, but is a body lighter than the air itself in which it floats, and is wafted at the same speed as the air itself travels, as if it were a part of the moving body. The wide expanse of sea offers no impediment to the undertaking, and a machine as large as the Nassau balloon could easily be fitted up for the reception of three persons, and victualled for three or four months if necessary. The machine could be lowered to the earth and ascend as often as it pleased the voyagers, by the adoption of the same plans as those used in the voyage to Germany. Mr. Green having established the facts of a current of air continually passing round the earth in the direction of west-north-west, the capability of his machine to retain the carburetted hydrogen gas for an unlimited time, and of its power of sustaining itself in the air for weeks—under these circumstances, and trusting to the faith he has always endeavoured to keep with the public, as a claim to their confidence on this occasion, offers to take upon himself to traverse the Atlantic from New York to England, in a balloon to be constructed for that purpose, and that he will make the experiment without any reward for his exertions.

POST-OFFICE REFORM.

After many fruitless attempts to move that ponderous mass, the administration of the British Post Office, a mighty lever was obtained, capable of overcoming its inertia, and giving a proper direction to its motion. That lever was the appointment, last year, of a Committee of the House of Commons, to examine and report upon Mr. Rowland Hill's plan for establishing a uniform penny postage throughout this kingdom. After a protracted and laborious investigation, and the examination of three hundred witnesses, the Committee drew up an elaborate report, asserting the practicability of the system propounded by Mr. Hill, and recommending its adoption, not as a matter of convenience to a few, or as a source of revenue and patronage, but as a great national measure, calculated to promote the best interests of society—a consideration of paramount importance with all well-wishers to their country. Even the *Quarterly Review*, an enemy to the measure, declares that "No one can rate higher than we do the paramount advantages of a cheap, rapid, and certain post-communication to the commercial, intellectual, and social interests of mankind. *That*, we repeat, is the first object—the consideration of revenue is subordinate—very important, no doubt, but subordinate." As the friends and supporters of this great measure increased in numbers and influence, its opponents became more tractable, and qualified and tempered, or wholly abandoned their opposition. The wishes of the nation, expressed by thousands of petitions, and supported by unanswerable arguments in the House of Commons, at length prevailed, and the uniform penny postage was decreed by an overwhelming majority of the legislature. We rejoiced in anticipation of the speedy attainment of the desired object, but recommended the friends of the Bill to be vigilant, lest the insidious manoeuvres of its opponents, and the astuceous perfidy of some of its pretended friends should prevail, and prevent the intentions of Parliament from being carried into effect. We have now still stronger reasons for believing that our fears were not unfounded. Mr. Hill has been sent to Paris by the British government, and, by comparing dates, it appears that a loose and remarkably unskilful document, called a "Treasury Minute," has been concocted during his absence; it is a sort of half, or rather a quarter measure, prescribing a fourpenny postage to distant places, and in the London district, the most important in the kingdom, a complication of absurdities which will be found extremely inconvenient to commerce, and, in many cases, more costly than the old system. Some letters are to be pre-payed, others are not; some are to be charged by weight, others are to be charged according to the old system—in short, if it were intended to discredit the measure for the purpose of depriving the nation of the promised benefit, a better plan could scarcely be pursued. A vast majority of the people of this country desire the uniform penny postage; but its enemies, though comparatively few, are powerful and active; and nothing short of the most vigorous, unanimous, and unceasing exertions can insure its ultimate triumph.

RAILWAY *versus* STAGE-COACH TRAVELLING.

There is no country in the world where stage-coaches are so well "appointed" as they are in Great Britain, in the matters of speed, safety, regularity, and comfort—but these merits are growing old fashioned; and steam carriages are the popular wonder, as well they may be. Without, therefore, intending disrespect to the old vehicles, which have carried us so long, so fast, and so far, it may be useful to point out some of the more obvious circumstances of advantage pertaining to the road steamers, as at present managed. In the first place, on going to the booking office in connexion with the coach, after weathering a dousing rain, we are sometimes greeted with the very unpleasant response, "No room inside, ma'am,"—or gentlemen after panting a mile in the middle of one of the dog-days learn, that "every outside place is taken." This never happens at the railway station—there is always room—be the passengers ten, fifty, or five hundred, it matters not—all are booked—all get the best places! In starting the railroad trains, there are none of those terrific piles of luggage, which often render many of the coaches so frightfully and dangerously top-heavy. A passenger, who must often be reasonably alarmed at the lading of a coach, sees or hears packages of almost any number, weight, or bulk, placed on the railroad carriage without the slightest apprehension. And then in taking your places, there is no competition for the "box seat," or the "front seat,"—no clambering over dirty wheels, excoriating your shins on sharp irons, until wedged amidst piles of luggage, your seat is taken on the lofty unsheltered platform, round which numerous legs hang dangling like a dozen brace of black and white grouse. To be sure the roof of a coach is sometimes pleasant enough on a fine summer's day, with a fine country on either hand, and a good road below; and even when it rains, if you happen to have an umbrella, and if your neighbour, being without, should happen to be good natured enough to endure the drip upon his neck, all may be tolerable, though anything but comfortable; but in the railroad carriage there are no outside places. Every passenger is sheltered, whether the poor woman that pays sixpence to ride six miles, or the rich man that pays one pound to ride a hundred. And then what a mechanical miracle is railway speed! How the train, whatever its length, does bowl along! What a "hish" on passing a bridge or another set of carriages. How the objects on each side flit by—how the colts, calves, and sheep, scamper off in surprise—how the cottagers come to their doors and the husbandmen pause in their work, to gaze and wonder! And yet, amidst all this astounding speed there is no plying of the whip, no tugging at the reins—no cruelty to horses. And who, possessed of any sensibility, can witness the turgid veins, the lathering skin, and the frothing mouth of the generous steeds, without some misgiving as to man's right so to use—or rather abuse God's creatures! The locomotive steam-engine, indeed, as if it were a thing of life, does sometimes pant and snort in grand style; but animal sensibility is not present—the bones here are iron and brass—the circulating fluids are water and vapour—the tireless tendons are rods of steel. Here, no hair-brained passenger is allowed to urge the driver on to hazard the lives or limbs of his companions; the engineer is the sole judge of fast or slow—he never for a moment either listens to bad advice, or lends the rein to an amateur driver. But it will be said a wheel may fly off or break. What then? It is true, the leaping out of a linch-pin, or the smashing of a felloe, must lead to the upsetting of a coach—but a railroad carriage can afford to lose one or two wheels, and nothing serious be the matter. At any rate, the boiler may burst—and then terrible would be the consequences? But whoever heard of a railroad boiler bursting? No one; the fact is, the boiler cannot burst—as any person may presently satisfy himself, from an inspection of the construction of one—it will be found to be formed in the middle of a series of tubes, any of which bursting, would cause a pretty buzz in the casing—but nothing more. But assuredly sometimes, after all, terrific accidents occur. So they do; but under what circumstances? Why, in nearly all instances, from the negligence of individuals who ought to have kept out of danger. It is very certain, that if a person chooses to place himself in the way of a passing train, he will be as certainly run down by a train of steam carriages as by a stage-coach, *plus* the velocity and numbers of the former. But bating cases of this kind, nothing is more remarkable in the history of steam travelling, than the small amount of injury to life or limb, which has been sustained; the instances of fatality arising solely not from any cause peculiar to the steam machinery as such, are few indeed, or rather none at all—for it is very remarkable, that, as yet, not one person has

been killed by any accident arising from the nature of this kind of locomotion exclusively. In the last place may be mentioned the comfort arising from the regulation, that no fees are given to servants. —*Railway Mag.*

STEAM COMMUNICATION WITH INDIA.

A Letter written on board the Atalanta *Steamer, and sent by the* Berenice.

"I GOT to Bombay on the morning of the 23rd, having left Agra on the 2nd, this includes two days' stoppages. I think, however, to perform the journey in any comfort, six camels and thirty days, so as to allow of longer halts, would be necessary. I kept the Dawk road the whole way, going direct from Gwallor by Seperes and Saringapore to Rajwas, where Captain M'Mahon's Russallah is stationed, then to Indore. Somewhat less than sixty miles from Indore, I descended the Jhaum Ghaut, a road very trying for the camels' feet, to Mundlesur; and thence, by a most miserable road, through a rocky jungle four days, to Dhoolia, *via* the Sindwa Ghaut. The latter is in Candeish, and the first Bombay station on the route. Thence to Bombay are staging bungalows, at convenient distances, and bearers can be procured in sets to go the whole distance. The country under the native chiefs is desolate, that is, compared to the Bengal provinces. No trade; people poor; but impudent and uncivil only in Scindia's and Holkur country. The Bombay territories in Candeish do not certainly give a cursory observer a favourable idea of their condition. Whether the Ryotwa system is to blame in this I don't know certainly; but I cannot help thinking that the arguments against it are as forcible in practice as in theory; still the people are much better off than in the native States. The journey to Bombay from Agra will, I doubt not, be frequently performed a few years hence; at present we do not know anything about it. The road I came has, I believe, advantages; but the voyager must not think his trouble at an end on reaching Bombay; or that the steam-packets are equal to passenger-Indiamen in accommodation. In fact, I cannot conceive how a lady manages. We have, however, five; there are only seven very small cabins, into each of which two people are crammed: no room to swing cots. Eight other deluded individuals (of whom I am one) are given to understand, that a cabin passage is included in permission to sleep on the benches and tables of the cuddy. For this you pay 200 rupees extra. The vessel is dirty beyond measure, from the soot and with the difficulty of copious ablution; and private accommodation is almost worse to a lover of Indian habits than the journey to Bombay from Agra on camels. No civility is to be got from the officers. If they are not directly uncivil, you are luckier than we have hitherto been. They declare themselves disgusted with passenger-ships, but do not take the proper way of showing their superiority to the duty. Egypt is, I hear, still plagued with four-footed things; indeed the Bombay Presidency suffers in some degree from a like pestilence; and the steamers on the other side are said not to be better than on this. One thing, we have abundance of good food, and good plain wines. We have only to shut our eyes to the process of the *cuisine*, and all is right."—*Bombay Times*, June 8, 1839.

THE STEAM MEETING AT MOORSHEDABAD.

June 3, 1839.—We record with sincere gratification the proceedings of the general meeting for the furtherance of the great cause of Comprehensive Steam Communication, which took place at this station this day. The attempt of our zealous chairman to secure to his noble enterprise the aid of a new and combined effort of all classes and castes of our community has, we rejoice to say, met with the most encouraging success. A crowded assembly of the principal European inhabitants, the Moosulman nobility of Moorshedabad, and the titled and other Hindoo gentry of this station—a longer list of distinguished names than it has ever before been the lot of our scanty columns to sustain—evinced in the strongest terms the interest with which all ranks of this society regard the splendid project of drawing closer the bonds of union between India and her island mistress, by means of the rapid intercourse of navigation by steam. Religious enthusiasm, commercial and agricultural enterprise, and the thirst for social and intellectual improvement, were alike appealed to; and a series of resolutions, supported by several of the highest personages in both sections of the native community, and carried by the unanimous voice of the meeting, called on all zealous Moosulmans, on the merchant and landholder, and on every friend, whether Hindoo or Mohamedan, to the prosperity of his native country, to join in promoting the success of a scheme which, in the comprehensive circle of its promised

benefits, was fraught with advantage to all classes of Indian society; and as an earnest that the assembly was prepared to act as well as talk, fifty-nine shares taken on the spot, have raised the united purchase at the two Berhampore meetings to eighty-two shares, and placed at the disposal of the Directors of the New Bengal Steam Fund in England, towards the realization of this noble undertaking, the sum of 41,000 rupees in the name of the society of Moorshedabad.

ON METALS AND THEIR COMBINATIONS.

THE word metal in chemistry is applied to any substance which possesses the following peculiar properties:—1. It must conduct electricity and heat. 2. When the compounds which it forms with oxygen, chlorine, sulphur, &c., are properly submitted to the action of a powerful galvanic battery, decomposition ensues, the metal always appearing at the negative pole of the battery; it is therefore said to be a positive electric. 3. Opacity, for although hammered into thin leaves, it refuses a passage to light; take gold leaf, for example, which does not exceed the $\frac{1}{282020}$th of an inch in thickness. They are generally good reflectors of light, possessing a peculiar lustre, which is called the metallic lustre. Every element which possesses these properties is termed a metal.

The number of metals known up to the present time is forty-one. The following are the names which have been given to them, and which for conveniency are divided into two classes:—

CLASS 1. Metals which by oxidation form alkalies and earths.

Potassium	Aluminum
Barium	Zirenium
Magnesium	Lithum
Glacinum	Calcium
Sodium	Therium
Strontium	Ytrium.

CLASS 2. Metals, the oxides of which are neither alkalies nor earths.

Manganese	Bismuth
Tin	Copper
Nickel	Silver
Vanadium	Palladium
Columbium	Iridium
Cerium	Iron
Tellurium	Cobalt
Mercury	Chromium
Platinum	Tungsten
Osmium	Uranium
Zinc	Titanium
Cadmium	Lead
Arsenic	Gold
Molybdenum	Rhodium.
Antimony	

Most of the metals have a great specific gravity, which was thought to be a general property of them, until the researches of Sir Humphrey Davy in discovering potassium and sodium, proved it to be an error. Malleability, ductility, tenacity, hardness, and solidity, are properties possessed by some metals. Mercury is the only metal which is fluid at common temperatures. Some metals are volatilized by heat, such as cadmium, arsenic, mercury, &c., while others are, on the contrary, quite fixed. Some metals readily combine with each other, forming alloys, except those in which mercury is a constituent, which are called amalgams. An amalgam of tin is used on a large scale for silvering of looking-glasses. The amalgam used for exciting the electrical machine, is composed of 1 part of zinc, 1 of tin, and 2 of mercury; the zinc and tin should be melted first, and the mercury then stirred in. Gold readily combines with mercury, forming a white-coloured amalgam. Potassium and sodium also unite with mercury, forming solid amalgams; they are separated by the addition of water, a solution of potassa being formed, while the mercury falls to the bottom. There are several alloys of copper, bronze, bell-metal, and speculum metal; for telescopes are copper alloyed with tin, differing only in proportion. Copper alloyed with zinc in different proportions, forms the various kinds of brass, Dutch gold, &c. Copper alloyed with a small quantity of arsenic, forms an alloy so white, that it has been mistaken for silver. Spoons and other articles which used to be sold under the name of British plate, and are, I believe, now selling, were probably made of this alloy; but as I have not proved the existence of any other metal than copper at present, I cannot presume to state that arsenic is a constituent.

A. TAYLOR.

(To be continued.)

MISCELLANEA.

South-eastern Railway—The Shakspeare Tunnel.—This tunnel, with its lofty Gothic arches of thirty feet high, begins to shadow forth its ultimate effect. The passage through, our readers are aware, has long been completed; but as this excavation is principally that stratum of the chalk, called by Phillips "the chalk of abundant organic remains," which possesses the property

of being at the same time of great hardness and in small detached masses wanting cohesion, the progress has not hitherto been so rapid; and in many places more brick arching has been used than was at first contemplated. The work is beautiful in its execution, and of great durability. Passing through this tunnel, we come upon a vast platform, which forms the termination of Shakspeare Tunnel, and the commencement of that of Abbot's Cliff. This latter is longer than the former; but as the chalk is much freer in its working, and more cohesive, some alterations will be permitted in the size and height of its tunnel, so as to admit of its being more expeditiously worked. The shafts, drift-ways, and galleries of this tunnel are complete. Beyond this, one comes upon the wall, now in a state of forwardness; this wall is formed from a concrete of the grey chalk, or Halling lime, and the beach of the sea-shore. Its base is about thirty feet in thickness, and decreased upwards: and the top of the wall will be about twenty feet above high-water mark; that part of it approaching to completion is very hard and appears of great durability. From this wall a gallery leads to Little Switzerland, or the Warren; and through the Warren the railway is conducted to Martello Tower, No. 1. The earth cuttings in this part are proceeding very rapidly, there being nearly four hundred men employed in a short space. At Tower, No. 1, the road turns and continues to Beachborough hill in a straight line, passing over the junction of the Dover and Canterbury roads in its progress; the bridge for this viaduct is commenced. Of the farther continuation of the line we know but little more than that we hear everything is going on successfully. The present pressure upon the money market has, doubtless, much influenced the price of these securities, in common with others; but it must be some consolation to distant shareholders to learn that, though the value in the market has receded, the expectations and confidence of the local proprietors have risen more than cent. per cent. during the last few months, convinced, as they appear to be, that the natural difficulties which have opposed themselves hitherto, are disappearing rapidly before the well-directed energy and perseverance of the conductors.—*Dover Chronicle.*

Pilgrimage to Ferney.—" More than ten thousand strangers visit annually the country-house of Voltaire, at Ferney, near Geneva. It may be, therefore, supposed, that the post of cicerone is productive to its owner. A Genevese, an excellent calculator, as are all his countrymen, has valued as follows the yearly profits that functionary derives from his situation.—8,000 busts of Voltaire, made with earth of Ferney, at a franc a piece, 8,000 francs; 1,200 autograph letters, at 20 francs, 24,000 francs; 500 walking canes of Voltaire, at 50 francs each, 25,000 francs; 300 veritable wigs of Voltaire, at 100 francs, 30,000 francs. In all, 87,000 frans."—[The above story has just started on its travels to " go the round of the press." The owner of the Chatau Voltaire not being unknown to us, we take the liberty of contradicting that part which relates to unfair traffic with spurious articles. The bed-room is preserved with the original furniture as when occupied by the great philosopher. It contains a portrait of Frederick of Prussia, presented by that Prince to M. Voltaire, and one of Dr. Franklin, who was a great favourite with Voltaire. There is an urn containing the heart of " the universal legatee of the age of Louis XIV.", with this motto;—" Sou cœur est ici, sou esprit est partout." (His heart is here, his mind is everywhere.) The liberal owner of the chatau (M. de Budet) submits to some degree of annoyance, for the accommodation of the public; no charge is made, but it is usual to give a trifle to the servant who conducts a party of strangers to " the lions" of the house and gardens, as is *allowed* in Windsor Castle, and *exacted* in several of our churches. We should not throw stones at our neighbours' windows, when our own house is made of glass.]

Economy in Bread.—Boil 5 lbs. of bran in water, strain it, and with the liquor knead 56 lbs. of flour, adding the usual quantity of salt and yeast. The dough will weigh about 94 lbs. 13 oz., or 8 lbs. 10 oz. more than the same quantity of flour kneaded in the common way; the loss of baking will be about 10 lbs. 5 oz., the gain from the use of the bran being about 14 lbs., that is, a clear increase of one-fifth of the usual quantity of bread from a given quantity of flour. The bran, after being used in this way, is equally fit for many domestic purposes. Bread is greatly improved in flavour and colour by the addition of half a pound of rice (having been boiled fifty minutes in two quarts of water) to a peck of flour; and what is more, it increases the loaf very materially, and is the saving of one shilling in six.

Seasonable Hints on Guns.— Never take a loaded gun into the house, and never load it there, and never carry a gun in such a position as if, were it to go off, it must strike a fellow creature. It will be no excuse to others in such a case, or to yourself to say, " you did not think it would go off." No man has a right to be thoughtless that carries a loaded gun. The man who does not think, is deficient in the first qualification of a sportsman. Let us also warn our sporting reader never to carry his gun with the hammer resting on the nipple, lest in going through a hedge, or passing by anything or anybody, it should receive a blow, and the gun go off. Lastly, never use your gun to clear away thorns in a hedge, and never give your neighbour his gun with the muzzle pointed towards him or towards yourself. And, above everything, never point even an unloaded gun at anyone in sport. It may teach others to do the same thing where a gun has been loaded without their knowledge.

Sporting without Certificates.—A person sporting without a certificate is liable to three processes. First, a penalty, under the Game Act, of not more than five pounds, and on non-payment may be imprisoned, to hard labour or not, for not exceeding three calendar months; second, a penalty under the Assessed Taxes Acts, of not more than 20*l.*, nor less than 10*l.*, and on non-payment may be committed (if no goods to restrain), but not to hard labour, for not exceeding six calendar months; a surcharge, under assessed taxes, for double certificate duty, 7*l.* 7*s.*, and if no goods to levy upon, may be committed, but not to hard

labour, until the money is paid, unless the Board of Stamps and Taxes choose to liberate. It is the intention of the Commissioners to publish the names and residences of all persons surcharged in double-duty for sporting without certificates. The judges have also recently decided that persons who are spectators of a hunt are also liable to double duty for a certificate, even though they may have been invited to join the party.

Usefulness of Pheasants.—The phesant is particularly beneficial to the farmer, a circumstance not generally known. This was fully proved a short time since at Whitney Court, Hertfordshire, where J. Day, Esq., shot a hen pheasant, in the craw of which, on being opened, were discovered more than half a pint of that destructive insect, the wire-worm.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton-buildings, Chancery-lane. Wednesday, Dec. 4, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 5, G. A. F. Wilks, M. D., Lecturer at the North London and Westminster Hospital Schools of Medicine, on Botany. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Dec. 6, Dr. M. Truman, on Organic Matter. At half-past eight.

QUERIES.

What is the plan laid down for setting out the longitudinal lines, and the parallels of latitude, on maps? H. P.

The way in which alcohol is stained of a blue colour, so as to be more apparent in spirit thermometers, &c.? It will not dissolve sulphate of copper. T. S. R.

How to make cayenne and other kinds of lozenges? A. C.

Having read in Nos. 8 and 9 (N. S.) of your instructive journal, that a correspondent, "J. L." was so kind as to offer to give every information in his power to another correspondent, "A Subscriber," in reference to the construction of a velocipede, and being desirous of making such a machine, I beg to avail myself, with your permission, of the opportunity of soliciting a similar kindness. Being anxious of having a velocipede upon the most approved principle, I should be peculiarly obliged to any of your correspondents who might render me any information in reference thereto. T. Ireland.

"What kind of an instrument is used by some of the teachers of systematic writing to fix on the hand of an adult who has got an inveterate habit of holding the pen wrong, and a very stiff hand to compel them to hold it in proper position?" I should feel much obliged also if your correspondent, who gave an answer to "H. R. S.," in No. 25, would describe the aidegraph, or state the name where it can be procured, as I tried all the shops likely where he mentions, and twenty other principal fancy stationers, &c., in London, and not any of them had heard anything of such an instrument. If you can give publicity to this in your valuable work, I trust it would not only prove interesting and useful to your humble servant, but if it should lead to the description of an instrument that would answer the purpose, prove invaluable to many hundred mechanics, who find great difficulty in overcoming stiff hands and bad habits. A Self-taught Subscriber.

TO CORRESPONDENTS.

Gamma.—*The proper construction of toothed wheels, on a wheel and pinion, is a subject of considerable difficulty; till recently, the epicycloid has been considered the fittest form; but a spiral curve is now preferred. The size and shape of the acting surfaces being determined, the proper depth is that at which equal motions of the wheel, will communicate equal motions to the pinion, and* vice versa. *When there is a succession of wheels and pinions as in a clock or watch, there is,* cæteris paribus, *the greatest friction on the pivots or axes, when they recede from the first mobile in a straight line; and the minimum of friction is when the third wheel returns in a straight line towards the first, and the relative friction of any position may easily be shown, by the resolution of forces, the action of the wheel and pinion, being nothing more than a succession of levers. His other query we defer for the present, not being in possession of the facts required for an accurate answer; but it shall be answered or inserted at the earliest opportunity.*

Alpha.—*Do you recollect the fable of washing the blackamoor white? The attempt to persuade mankind to abandon vice, is equally vain; but he who by argument, example, or even by the severest coersion, does in any degree arrest the deadly contagion, renders an important service to society. Drunkenness is the Devil's hot-bed, where he sows the seeds of the most frightful crimes that degraded humanity blushes to own; and is one of the most conspicuous of the innumerable proofs that vice is misery, and virtue is happiness. Much might be said upon this subject; but it is not sufficiently technical for the "Mechanic and Chemist."*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 64, NEW SERIES. | SATURDAY, DEC. 7, 1839. PRICE ONE PENNY. | No. 185, OLD SERIES.

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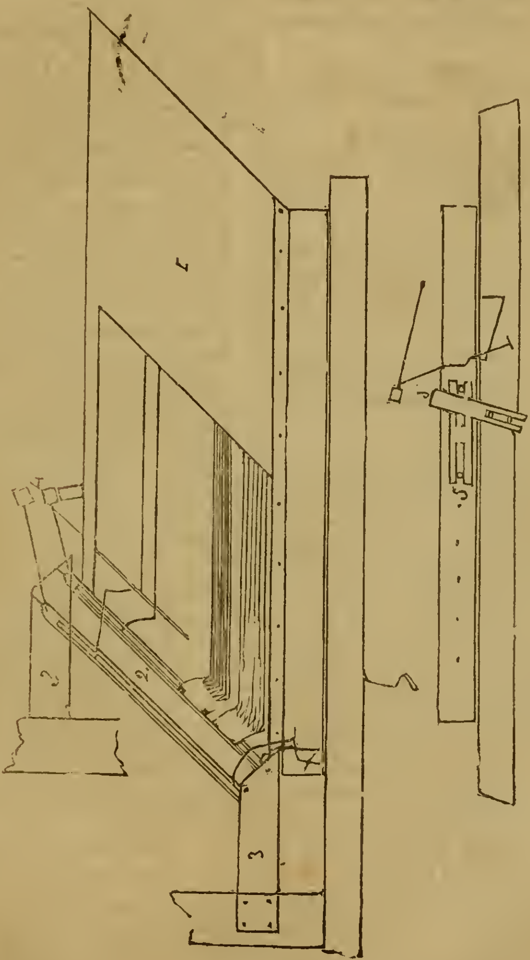
FIG. A. FIG. B.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

CARY'S RULING MACHINE.

(See Engraving, front page.)

FIG. A; 1, is a deal board one inch thick, made the same size as the press-stone, upon which it is fixed in the same manner as a form of type; a piece of reglet is fixed on the board the whole length of the near edge, to place the sheets even with; 2, is a slide to hold the pens; it is formed of two strips of wood, each one inch wide, and three-eighths thick, glued together at each end, with a piece a quarter of an inch thick inserted between them, and 3 inches long, so that the two together form a slide one inch square, with a slit a quarter of an inch wide, reaching to within three inches of each end, into which the pens are fixed by small wood wedges; 3, 3, are two pieces of half-inch board, with brass pivot-holes let into them, in which the pivots in the ends of the slide turn; these boards are screwed to the sides of the press, so as to support the slides parallel to the front edge of the platen; at the farther end of the slide is a piece of stout iron wire, about six inches long, terminating in a lead knob, 4, which by its weight turns the slide partly round, bringing the pens to bear on the paper; another piece of wire is attached closely to the knob of a joint, and hanging down by the side of the press, as shown at fig. B, passes through a wire guide, rests on a flat iron stud driven into the side of the press, supporting the weight, and keeping the pens raised off the paper; 5, is a piece of iron plate fixed on the side of the sliding bed, with a pin in the centre projecting about half an inch, for the purpose of striking the supporting wire off the stud, when the press is wound in far enough, thus letting the pens down for ruling; 6, is another piece of iron plate, fixed on the frame of the press, the end of which catches the weight, to prevent so great a pressure on the pens. The wire for raising the slides is fixed at the near end, bent down, so that a pin projecting from the side of the bed shall strike against it in running back the press, just when the top edge of the board comes under the pens. This is all that is necessary when the lines are all of equal lengths; but when there is a lead line, some of the up lines are required to run through, and others to stop at it, as in the sketch, where a sheet is represented as fully ruled; then make use of an additional slide, which is placed over the first-mentioned one, into which the pens for ruling the short lines are fixed by means of a stout wire-holder, long enough to reach over the under slide, and bent so as to bring the pens in a line with the others; the rail of this slide falls on the knob of the under one, and the raising wire lies by the side of the other, but has an adjusting screw at its point for the pin to strike against, by altering which, this slide is made to rise before the other, sooner or later, according to the difference required in the lengths of the lines.

The method of using the machine is as follows:—Supposing the press open, the pens raised off the paper, the weights being supported on the stud, in the off-side of the press; having laid about half-a-dozen sheets of large smooth paper on the board to rule upon, lay the sheet to be ruled upon them, bringing the side closely to the reglet, and the top even with the top or left hand edge of the board; then wind in the press, when the bottom edge of the sheet comes under the pens, the knocking down plate, 5, having been adjusted according to the size of the sheet, the pen strikes the supporting wire off the stud, down falls the weight upon the end of the catch plate, 6, bringing the pens down on the paper for ruling, then steadying the sheet with one finger, when the top of the sheet passes under the point of the pens, the pin in the near side of the bed strikes the raising wires, lifting up the slides till the supporting wire rests on the stud in the off-side of the press; the sheet is then removed, and another placed, proceeding as before.

The advantages of this machine over those in general use, are—First, its simplicity and cheapness; secondly, that though it does the work as fast and as well as any other machine, it only requires one person, instead of two, or more; thirdly, when lines are of unequal lengths, instead of ruling them at twice, which is usually the case, they may just as easily be done at once, without requiring the least additional time or care.

When the ruling machine is done with, it may all be disengaged from the press in a few minutes; by drawing back the pivot holes, which are made to screw in and out for the purpose, in the board, on the near side, the slides will be detached; loosen the screws of the catch plate, take that and the board away, and nothing will be left to interfere with the working of the press.

J. H. CARY, Shepton Mallet.

An Owl "far, far at Sea!"—The ship *Margaret*, lately arrived from Quebec, brought home a prisoner of rather an extraordinary description—a fine owl, which was captured at sea, not less than five hundred miles from any land.

PROGRESS OF THE RAILWAY SYSTEM.

This may be termed the "Railroadian Era" in the world's eventful history. The grass will shortly be found growing in luxuriance and the brightest verdure, on the "Great North," or the "Western Roads," while the "long stages," the "Hi rondelies," "Heroes," "Highflyers," and "Tartars," will soon only be thought of with as much contempt, and their placards, announcing that 220 miles could be performed in twenty hours, looked upon with as much curiosity as the announcement that the "York mail would be *four days* (God willing) in performing its journey to London." A year or two ago, we thought that if we could leave Manchester or Liverpool at ten o'clock, a. m., and arrive in London in time for breakfast next morning, we were doing tolerably well, and our friends on our departure did not fail to express their solicitude as to our *bon voyage*. But now, by making a little exertion, and rising an hour or two earlier, we can start to London in the morning, and arrive in the metropolis at an early hour in the afternoon of the same day, and no one ever thinks it worth while to wish us a safe arrival. We can seat ourselves as comfortably in a first-class carriage as in our own sitting-room, and if we choose to play the luxurious, can sleep all the way in "a bed-carriage," composing ourselves on our departure, and awaking to all the comforts of metropolitan fog, crowd, and confusion. But this change in the mode of transit has not been effected without the sacrifice of some interests—not without bringing great and crying evils—not without entailing upon us some abuses. A mighty movement has been made—an enormous stride has been taken by the giant—Intellect. Time is laughed at—distance is accounted nothing. The mere laying down a bar of iron, and the application of steam, have wrought the most wonderful change that has ever taken place among us. But will the result be beneficial, or will it not? The philosopher and the moralist may ponder upon the change—the theorist may speculate and lay down his wild fancies, and persuade thousands that they are based upon a firm foundation; and he may daily make converts, until one little touch of experience dissolves the dream away and shows all its fallacies. The thoughtful man may paint a picture of the future—he may do it in a masterly manner—but it may prove unlike. Railways, which were at first mere private speculations, have now become altogether national; immense sums have been embarked in their formation, and as they spread far and wide, they become monopolies, and are daily altering the face of our commercial, and, perhaps, social intercourse. Since, then, they have become thus powerful and national, it behoves the legislature to look closely after them, and to take care that the public welfare is not sacrificed to private or collective interests.—*Chester Gazette.*

ON METALS AND THEIR COMBINATIONS.

(*Continued from page* 100.)

Having in the first part explained the chief characteristic properties of metals, and their combination with each other, I shall now proceed with the combination of metals with non-metallic elements, namely, oxygen, chlorine, iodine, bromine, fluorine, sulphur, phosphorus, carbon, and hydrogen, and generally in more than one proportion; the resulting compounds are termed oxides, except where an acid is produced, as with arsenic, antimony, chromium, &c. The means by which they absorb oxygen, is termed oxidation; and the menstruums by which this is effected, are called oxidizing agents. Some of the metals become oxidized by mere exposure to air, but most of them require more powerful agents, such as nitric acid, or nitro-hydrochloric acid. The oxides thus formed may be reduced to the metallic state by deoxidizing agents. The oxides of gold, platinum, &c., are reduced by the mere agency of heat alone, while those of lead and tin, and many others, are reduced by means of heat and combustible matter; but the reduction of the oxides of barium, strontium, &c., are much more difficult, having only been effected by the agency of galvanism. Most of the metallic oxides are capable of combining with acids to form a class of compounds termed salts.

Chlorine has a great affinity for metals; so great in many cases, that the combination is accompanied with heat and light. The soluble chlorides decompose water when added to it, the oxygen of the water uniting with the metal, forming an oxide, while the hydrogen combines with the chlorine, forming hydrochloric acid; a hydrochlorate is therefore the result.

Iodine has a great affinity for metals, although much inferior to chlorine; its compounds are termed iodides. All the iodides are decomposed by chlorine, bromine, and strong sulphuric or nitric acids.

Bromine has a strong affinity for most

metals, forming compounds which are termed bromides. The action of bromine in some cases is very intense, being accompanied with heat and light in a similar manner to chlorine. The bromides. are formed by the action of bromine on the metals themselves, or by adding hydrobromic acid to the oxides of the metals, and then evaporating the solution to dryness.

Fluorine appears to have a strong affinity for most of the metals, but its direct action on the pure metals is not at present known. The soluble fluorides are prepared by adding the carbonates to hydrofluoric acid, and evaporating to dryness. They are decomposed by the addition of strong sulphuric acid with the aid of heat; the presence of the fluoric acid which escapes is soon detected by its action on glass, which it instantly corrodes. Care should be taken that it does not escape in a large quantity, as it is sure to spoil almost everything around it. The affinity of sulphur for metals is also very great; it combines with them in many different ways. The combination may be effected in most cases by mixing the metal in small particles with sulphur, and exposing the mixture to heat, or they may be prepared by heating the sulphate of the oxide of a metal with charcoal. Most of the sulphurets may be prepared in a hydrated state, by passing a stream of sulphuretted hydrogen gas through a solution of any soluble salt of a metal. The salts of uranium, iron, manganese, cobalt, and nickel, are exceptions to it, but these are precipitated by sulphuret of potassium. A great many of the sulphurets are found native, and those of iron, lead, and antimony in great abundance.

Phosphorus is also capable of combining with metals, forming a class of compounds which are termed phosphurets. They may be prepared by bringing phosphorus in contact with metals at a high temperature; some of them are prepared by heating metals in contact with phosphoric acid and charcoal. Carbon unites with the metals, forming carburets. The only carburets of importance are those of iron. Plumbago (black-lead), cast iron, and steel, are all carburets of iron. Hydrogen combines with a few metals, to form what are termed hydurets. The only metals which possess this property, are zinc, potassium, arsenic, antimony, and tellurium.

A. Taylor.

WINTER MANAGEMENT OF. THE DAHLIA.

We have more than once had occasion to speak of the cultivation of this splendid flower. The facility with which it is propagated, as well as the well-known beauty of the plant, must always render it a decided favourite. It now blooms the brightest gem in the parterre; and a more splendid, or a greater acquisition to any collection of plants, is not at present known in the annals of floriculture. To those, therefore, who admire the dahlia, any remarks calculated to promote its cultivation must prove acceptable. The object at present aimed at, however, is the preservation of the root in winter. As the roots of this plant are seriously injured, and not unfrequently killed, if they are once suffered to be affected by the frost; it becomes indispensably necessary that means be employed to prevent its ingress to the place in which they are kept, and at the same time to prevent the roots from shrivelling, and to protect the vital principle. To accomplish this, requires the exercise of care and skill on the part of the cultivator. The plan we adopt, though at variance with general practice, has never yet disappointed our expectations; it is as follows:—When the stems are destroyed by frost, they should be cut down and removed, but the roots should be left in the ground, as experience proves that the roots so disposed of, produce their flowers much earlier in the succeeding season than if they were taken up and preserved in a house. To prevent the frosts from injuring the roots, they should be covered all winter with coal-ashes, saw-dust, or dung, sufficiently thick to prevent the frost from incrustating the ground beneath. In order to prevent their becoming too bulky in the plant—a circumstance which follows this practice—all the shoots as they come up must be pruned off, except one or two, according to circumstances; and this pruning should be continued during their whole growth, so as to model them into any size or form that may be required. By adopting this plan, as we have just observed, excellent and very early flowers may be obtained—otherwise, it is of little consequence where they are kept during the winter, so that they be dry, and secured from frost.—*Weekly Paper.*

Blue Dahlia.—A correspondent of the *Dorset County Chronicle* says, that "It is probable a blue dahlia might be obtained, by innoculating the seed vessels of a white one with a little of the pollen of the *osteospermum ceruleum*, which is a native of the

Cape of Good Hope, and bears a blue flower. The osteospermum and the dahlia belong to the same natural order and sub-order of plants, *composicæ helianthecæ*, and the osteospermum is the only one of the sub-order that bears a blue flower. All innoculation of plants, as every botanist well knows, must, to be fruitful, be from those of the same natural order.

DART'S INSTRUCTIVE FORFEIT GAME.

A PRETTY contrivance for rendering youthful amusement not only harmless, but instructive and useful. The game consists of draw-papers, cards, and a key, or book of directions. The draw-papers are little slips, each containing a sentence, indicating a number, directing to one of the cards; but, to know the number meant by the sentence, will generally require a little exercise of thought, and nothing tends to cultivate the mind more than that which leads to thinking. The cards are thirty-two in number, with a picture and verse on each; and the key affords the list of forfeits, explains the draw-papers, &c.

The explanatory rhymes do not sufficiently resemble poetry to inculcate a vicious taste, and many of them contain interesting information in astronomy, natural philosophy, natural history, &c. Some of them are in praise of *tee-totalism*, a science of small pretensions in point of edification, but harmless, and even beneficial in its effects, if not indulged in to excess. We recommend the "Forfeit Game" as an agreeable and profitable diversion for our juvenile friends, and the approaching "merry Christmas," will, we trust, occasion a demand commensurate with the labour and cost which has been bestowed upon it.

THE CHEMIST.

ACIDS.

NO. X.

Phosphoric acid may be formed by burning phosphorus in excess of oxygen. There are intense heat and light produced, and white deliquescent flocculi line the interior of the receiver. It is produced in the same way by burning phosphorus under a dry bell glass in atmospheric air. For this purpose a piece of phosphorus in a watch-glass or small porcelain capsule, may be placed upon a plate of glass, and covered over with a tall receiver; when inflamed, it burns at first furiously, but the combustion gradually subsides for want of air, and may be renewed by gently lifting the receiver off the glass plate; thus the whole of the phosphorus may be gradually burned, and it forms a quantity of dense smoke, which subsides in the form of snowy flakes; this is anhydrous phosphoric acid. If a little water be dropped upon it, it dissolves with a hissing noise, and much heat is evolved; but it is some time before the whole dissolves into a clear liquid. It is also soluble in alcohol. Its salts are termed *phosphates*.

Molybdic Acid.—To obtain this acid, the native sulphuret of molybdenum should be triturated as far as possible to powder, and distilled with three or four parts of nitric acid to dryness. This operation should be repeated till the ore is converted into a uniformly white mass, which consists of molybdic, nitric, and sulphuric acids; the two latter may be expelled by a red heat in a platina crucible, and the remaining molybdic acid repeatedly washed with boiling water, in which it is little soluble, will be nearly pure. It may be rendered perfectly pure by solution in ammonia, precipitation by nitric acid, and exposure to heat. The molybdic acid thus procured is a white powder, of the specific gravity of 3.46, and requiring 960 parts of boiling water for its solution, which is yellow, reddens litmus, but has no sour taste. If heated to redness in an open vessel, it slowly sublimes, and condenses in brilliant yellowish scales. It dissolves in hot sulphuric acid, forming a solution which is colourless while hot, but on cooling acquires a blue colour. Its salts are termed *molybdates*.

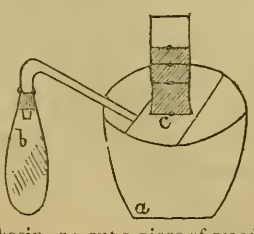
Purpuric acid may be obtained as follows:—Dissolve *pure* uric acid in diluted nitric acid, and saturate the excess of nitric acid in the solution by ammonia, then evaporate slowly, and red crystals will be separated, consisting of purpurate of ammonia; digest these in liquid potassa till the red colour disappears, then add sulphuric acid in quantity to saturate the potassa, the purpuric acid remains in the form of a yellowish powder without smell or taste, and nearly insoluble in water, alcohol, and ether, but soluble in the concentrated mineral acids. It contains metallic oxides, and expels carbonic acid from the alkaline carbonates, by the assistance of heat. With bases it forms salts termed *purpurates*.

Saccholactic Acid.—When sugar of milk is treated with nitric acid, it affords a peculiar acid similar to mucic acid obtained from gum. To procure this acid, one part of powdered gum-arabic may be digested

in two of nitric acid in a moderate heat; as soon as effervescence commences, set the flask in a cool place, and a quantity of white powder subsides, which is to be collected upon a filter, digested in dilute nitric acid to separate oxalate of lime, and subsequently purified by boiling water, which deposits the mucic or saccholactic acid on cooling. If sugar of milk be used instead of gum, it is obtained pure by the first operation. This acid is not crystallizable, and is sparingly soluble in water, requiring 60 parts at 212°, and is deposited as the solution cools. It combines with the metallic oxides, and forms a class of salts termed *saccholactates*.

Selenious Acid.—When a current of oxygen gas is passed over selenium, heated to its boiling point, it burns with a pale bluish green flame, and this acid sublimes and condenses in long brilliant prismatic crystals, provided the vessel into which it is received is cold and capacious, otherwise the sublimate is semifused and transparent; this is dry selenious acid; it loses its transparency by exposure to air, and rapidly absorbs water. Exposed to heat, the water separates again before the acid rises in vapour. Its taste is sour and hot, its odour, when sublimed, acid. It is very soluble in warm water, and the solution furnishes crystals of the hydrated acid. It also dissolves in alcohol, and furnishes on distillation a liquid of an ethereal odour. If this alcoholic solution be mixed with sulphuric acid, and then distilled, the product has an odour so insupportable, that Berzelius was unable to proceed in its examination. It forms salts called *selenites*.

To make Oxygen Gas.— Put some black oxide of manganese into a flask, and pour over it as much sulphuric acid as will just wet it. Set it in a sand-bath and make the sand hot; or hang it over a candle. By inserting a pipe through a cork, thrust into the neck, the gas may be collected in a bladder; but a much better way is by a pneumatic trough. To make this, take a



large basin, *a*; cut a piece of wood, *c*, half an inch thick, two or three inches broad, and rather shorter than the width of the basin so as to allow it to sink about an inch down. In the middle of the board bore a hole; and on the underside, as much lead as will cause it to sink in water. This being done, set it in the basin, and pour in as much water as will just cover it. Fill a vial with water, invert it, and set it over the hole. Cause a bent tube, proceeding from the flask, *b*, containing the manganese, to pass under the side of the board, so as to come exactly under the hole. As the gas comes over, it will rise into the vial, and displace the water. When nearly full, slide the vial to the side of the wood, and cork it. Leave a little water in to protect the bottom. Hot water must be poured upon the manganese directly, to prevent it from becoming solid, or the flask will be spoilt.

MISCELLANEA.

Novel Steam Apparatus.—The *Oxford Herald* gives the following description of an ingenious application of steam power, by which in the Oxford Union Workhouse, the whole of the clothing and other articles used in it are washed, dried, and ironed, in an almost incredibly short space of time. No less than 1,235 articles of apparel, bed-clothes, &c., were washed, dried, and ironed, in two days, with the assistance of only eight women, and two girls from the school. This unique and elegant machine is the invention of James Wapshare, Esq., of Bath, for which we understand he has obtained a patent. The apparatus consists of a small steam-boiler, with two pipes for the conveyance of steam. By the one pipe the steam is conducted to the coppers used for boiling the clothes, and supplying the washers with hot water; by the other the steam is carried to a closet, or large box, in which the linen is to be dried. The exterior of this box is a wooden frame, covered with zinc; within it is fitted up with pipes, increasing in number according to the extent of drying power required. These pipes are arranged horizontally, one above another, connected at one end by a bend or turn, thus forming a continued duct for the steam. The steam is admitted at the upper pipe, and passes its condensed water at the lowest. On either side of this tier of pipes is a moveable clothes-horse, which is drawn out to be hung with clothes. These horses are made close at the top of the box, so that no heat may *escape over* them, and the clothes are so disposed on them, as to form an entire sheet, completely enclosing and preventing any escape of the heat radiating from the pipes, except *by passing through* the articles to be dried. This disposition of the clothes is easily to be accomplished, but difficult of description. On the outside of the horses, or on that side which has not the pipes, a valve or opening is made on the top of the box, and a current of air being admitted at the bottom, the steam or moist air derived from the clothes as they dry, is carried off as fast as it is generated. One set of these

pipes, with two horses, would be sufficient for any moderate family. In an establishment so extensive as a Union Poor House, more is required. In the closet or box erected are three ranges of pipes, and consequently six horses, or two to each range, having an air space, with its valves, between each set of horses. Attached to the flue that surrounds the boiler is a small oven for heating the irons, so that the whole operation of the laundry, as far as heat is required, is simultaneously effected by one fire.

Cedar Quarries.—On asking a friend from Oswego, the other day, who used this term, what it meant, he informed us, that much of the cedar which comes from Lake Ontario is absolutely dug out of the soil. On some of the islands in that lake, which furnish great quantities of that valuable timber, there has not been growing a single tree for many years. Generation has apparently succeeded generation of this timber, and fallen, and been successively covered with earth, and is dug out for railroads, fence posts, &c., in a perfectly sound state. The above is from the Cultivator Persons who have been on the island have stated to us similar facts. We believe, however, the quarries are getting exhausted of their most valuable mineral—the red cedar—or that it is so deeply imbedded, that the labour of excavation is not sufficiently rewarded. During this season, nearly all the cedar importations have been of a white species. We have heard it stated, that on some of the islands—the ducks and pigeons, for instance, at the north-eastern termination of the lake—have made subterranean passages pervading their whole area; that the roof or exterior surface seems to be composed of agglomerated earth matted and held together by roots of trees which rest upon it, and have covered it with a thick growth of timber. The vaulted passages or dens below are filled with cedar logs lying in every variety of position, and which no doubt formerly, like the rafters of a house, gave support to the superincumbent mass. From the accounts we have had, there are more wonderful labyrinths constructed by nature on Lake Ontario, than that of old upon the banks of Lake Mœris.—*Oswego Palladium.* [Similar quarries exist, or did exist, in the Jersey marshes, between this city and Newark. Within our own day, we have seen people engaged in excavations for fencing timber. Thus cedar posts and rails were dug from the earth on one side of Newark, and blocks of free stone on the other.—*New York Com Adv.*]

To make Impressions of Leaves upon Silk, Satin, Paper, or any other Substance.—Prepare two rubbers of wash-leather, made by tying up wool or any other substance, in wash leather; then prepare the colours which you wish the leaves to be, by rubbing up with cold-drawn linseed oil the colours you want, as indigo for blue, chrome for yellow, indigo and chrome for green, &c.: get a number of leaves of the size and kind you wish to stamp, then dip the rubbers into the paint, and rub them one over the other, so that you may have but a small quantity of the composition upon the rubbers; place a leaf upon one rubber and moisten it gently with the other; take the leaf off and apply it to the substance you wish stamped; upon the leaf place a piece of white paper, press gently, and there will be a beautiful impression of all the veins of the leaf. It will be as well if only one leaf be used one time. The leaves picked should be of one size, as the work will not look uniform. E.

Beginning of Road-making.—The infancy of road-making, like that of navigation, must be sought in the infancy of nations. A canoe, hollowed out of the trunk of a tree, was the beginning of ship-building; and an Indian's trail, by which an untutored tribe wend their way in single files, through forest or glassy glade of boundless extent, is the first germ of a road. Conveyance by a quadruped, which rendered necessary the widening of the trail into a sort of bridle-path, formed, most likely, the second step in the improvement of itinerancy. Next came the use of carriages; a sledge, perhaps, first; after that the cart, or sledge, raised on two wheels, connected by an axle. Then came the double cart, or waggon of four wheels, by which two parallel and transverse axles were connected by a fixed longitudinal one. In principle, no improvement beyond this has been made in the construction of carriages, save that just alluded to, of the moveable joint, which at once, by the facilities it afforded for turning curved lines, dispensed with the necessity of rectilinear roads for large vehicles.—*Wade's Br tish History.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 12, G. A. F. Wilks, M. D., Lecturer at the North London and Westminster Hospital Schools of Medicine, on Botany. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Friday, Dec. 13, Mr. James Burton, on the Applications of Chemistry and Machinery. At half-past eight.

QUERIES.

Where can I obtain a model of a steam-engine and sugar mill, with boiling apparatus, such as are sent to the West Indies? R. H.

How to make Circassian cream? Also, how to solder copper and zinc plates together for galvanic purposes? A SUBSCRIBER.

In what way are the masks made which they use at the theatres, consisting of noses, foreheads, faces, &c.? They seem to be made of paper, if so, how are they moulded, and which is the best way of making them? J. S.

Could any of your numerous correspondents give me the receipt of the varnish used on cartoons for peaks of caps, and also for cambric or lawn? I have tried the receipts given in Vol. I., but they do not answer, they either run or are not a good black. OLIVER.

How to clean and polish shells? CRAPPEY.

1. How many cubic feet of gas are required to raise 100 lbs. 100 feet high? 2. How to make a magnetic needle for a compass? 3. How to make small leaden pipes? 4. How to make differently coloured stains for paper? 5. How to mix the colours for stencilling? 6. How to make the Drummond light? 7. How to polish glass? 8. How to transfer copies of prints on to wood blocks for cutting? 9. How to stain Cypress paper? 10. The construction of the Bude light? 11. Which is the lightest, silk or bladder, for a small balloon? H. D. Chard.

ANSWER TO QUERY.

Sir,—" B. C.'s" question can be solved by the Rule of *Position* in simple arithmetic:—If 12 quarts of wine be taken out of a wine tub, and 12 quarts of water be poured into it; if this operation be repeated four times, and if there then remain 54 quarts of pure wine in the tub, what was the original quantity contained therein?"

Suppose that 100 was the original number of quarts of wine in the tub;—

	Quarts.		Wine.		Water.
Then from	100				
Take	12				
	88				
Add of water	12				
	100	=	88.	+	12
From this mixture take....	12				
There remains	88	=	77.44	+	10.56
Add water	12				
	100	=	77.44	+	22.56
From the mixture take....	12				
	88	=	68.1472	+	19.8528
Add water	12				
	100	=	68.1472	+	31.8528
Again take	12				
	88	=	59.969536	+	28.030464
Add water	12				
	100	=	59 969536	+	40.030464
Take (fifth time)	12				
	88	=	52.77319168	+	35.22680832
Add water	12				
	100	=	52.77319168	+	47.22680832

The 100 quarts of mixture finally consisting of $\begin{cases}\text{Wine .... 52.77319168} \\ \text{Water .... 47.22680832}\end{cases}$

Then by the following proportion:—

Remaining. Original. Remain. Original.
52.77319168 : 100 :: 54 : 102.324;

Thus giving 102.324 quarts as the original quantity of wine contained in the tub.

To find the quantity of wine remaining after taking from the mixture 12 quarts, say as the 100 quarts of the mixture : wine contained in it :: the remaining 88 quarts : wine contained in it,

100 : 88 :: 88 : 77.4;

and in the same way with the others following. T. S. R.

TO CORRESPONDENTS.

A Cosmopolite *will find his query answered in a forthcoming article on lithography.*

A Constant Purchaser *will also find a description of the solar microscope, the optical construction of which is similar to that of the oxyhydrogen microscope, at the Adelaide Gallery.*

W. J. N.—*We will refer to the work he mentions, and shall then be able to explain the difficulty.*

A Subscriber.—*Copper and zinc may be soldered by the application of acid to the surfaces required to be joined—sulphuric acid, we believe, is usually employed.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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LAUHGING GAS.

NITROUS OXIDE, OR LAUGHING GAS.

It was at the risk of his life, that Sir H. Davy discovered the surprising properties of this gas: for previous to his experiment, it was supposed that death would be the consequence of introducing it into the lungs. Nitric oxide very nearly resembles it, and that gas cannot be inhaled without fatal consequences. We therefore feel it our duty to recommend that this experiment should not be made without the assistance of an experienced chemist. The following is extracted from "The Book of Experiments":—

"HOW TO MAKE LAUGHING GAS.

There are various methods of procuring this gas; but we think our readers will find it best to obtain it from nitrate of ammonia. This should be placed in a glass retort, and exposed to the flame of a spirit lamp. It will soon melt, and shortly afterwards the gas will be evolved. It should be collected in a receiver, placed in a pneumatic trough, as shown in the engraving, and allowed to stand a short time over water, in order to remove any impurities with which it may be contaminated. The nitrate of ammonia, when melted, should only be kept simmering; for if the heat be increased too much, it will cause a slight explosion, and nitric oxide and nitrogen gas will be produced. If it be wished to make a considerable quantity of the gas, it will be advisable, on the ground of cheapness, for the operator to prepare the nitrate of ammonia himself. This may be done by pouring diluted nitric acid on carbonate of ammonia, and evaporating the solution till the greater portion of the water is gone.

SINGULAR EFFECTS OF LAUGHING GAS.

Protoxide of nitrogen, nitrous oxide, or, as it is more generally termed, laughing gas, is a compound that the young chemist generally desires to procure as soon as possible; and we are induced, therefore, to give the following description of its properties, and of the method to be adopted for obtaining it in a state of purity, although he must not expect to do so without considerable trouble, and some disappointment. Nitrous oxide is a compound of the same elements as those which constitute the atmosphere; but, in consequence of containing a greater quantity of oxygen, its effects upon the human frame, when breathed for a short period, are very surprising. It is not a gas that can be breathed with impunity for any great length of time, yet it can be received into the lungs for a short period without injury. It is termed laughing gas, because its general effect upon persons who respire it is to induce a very strong desire to give way to violent fits of laughter. It does not, however, produce this effect on every individual. Some are made exceedingly melancholy, and others appear desirous of annihilating everything on which they can lay their hands. In general, however, the gas only excites the person who breathes it to laughter. It acts as a powerful stimulant for a time, but, unlike other stimulants, it is not followed by lassitude, or lowness of spirits, unless, while under its influence, the person is excited to excessive muscular exertion. Sir Humphrey Davy made a variety of experiments with this gas. He administered it to various persons, and, indeed, was the first to investigate its properties with any degree of accuracy. Previously to his time, the gas was considered to be unfit for the purpose of respiration, but Davy found that it could be breathed with safety; and in his farther experiments on it discovered the singular effects it produces. After a few inspirations of it have been made, it causes a sense of lightness and expansion in the chest, and a pleasurable sensation begins to extend over the whole body; this increases, and is accompanied with a desire to inhale the gas; respiration becomes, therefore, fuller, and is performed with more energy. Exhiliration is soon produced; and if the respiration is continued sufficiently long, a crowd of indistinct ideas, often in very singular combinations, pass through the mind; there is an irresistible propensity to laughter, and to muscular exertion, and violent efforts are made with alacrity and ease. These effects, after the inspiration has ceased, continue for four or five minutes, or sometimes longer; they gradually subside, and what is not the least singular, the state of the system returns almost immediately to its usual standard.

We have frequently administered the gas to others, and have breathed it ourselves; and when this is done in a proper manner, we have never failed to observe or feel the effects above described. There is, however, some difficulty in administering the gas properly to a person who has never taken it before. It must be enclosed in a bladder, fitted with a stopcock; and unless the person inhales it from the bladder without allowing any of the atmosphere to enter his lungs at the same time, the experiment will not succeed. The best way is, to close the nostrils with the left hand, and then, forcing all the air possible from the lungs by a strong respiration, to place the stopcock in your

mouth, and so breathe in and out of the bladder, at the same time keeping the nostrils quite closed. If this be done properly, the gas is sure to produce its usual effects. When it is administered to a person, unless he has taken it previously, and is aware of the manner in which it affects him, it is desirable to have some one near to prevent his doing any mischief, in case he should feel so inclined. Self-command is in general entirely lost for a few minutes, although the individual is perfectly sensible all the time in what a ridiculous manner he is behaving."

PRODUCTION OF GAS FROM WATER.

It is a general, though very erroneous supposition, that water is destitute of the elements of combustion ; it is, however, clearly demonstrated by chemical analysis, that water, though so opposed to combustion in its combined state, consists of oxygen and hydrogen, which, when combined in a different form, produce by their combustion the most intense heat, and a flame which, when projected against lime, generates the brightest light that can be obtained by artificial means. "Setting the Thames on fire" is no longer a proverbial impossibility ; for one of the inflammable elements, hydrogen, may be easily separated and collected by a simple process An experiment in gas-lighting was made last week by the Comte de Mal Varino on a piece of waste ground at the back of Fetter-lane, in the presence of several scientific gentlemen. The gasometer was connected by tubes with a brick furnace containing three retorts, one of which was supplied with water, and another with tar, and both discharged their produce into the third retort, in which the gaseous elements were decomposed. The novelty of the experiment consisted, in fact, that the principal agent employed to produce the gas, was common water combined with tar; but, according to the theory of the inventer, any sort of bituminous or fatty matter would answer the purpose equally as well as pitch or tar. After the lapse of about half an hour employed in the experiment, during which time the process was explained to the company, the gas was turned into the burners, and a pure and powerful light was produced, perfectly free from smoke or any unpleasant smell. The great advantage of this sort of gas over the common coal gas, consists, it was said, in the cheapness of the materials employed in its production, the facility with which it is manufactured, and the perfection to which it is at once brought, without the necessity of its undergoing the process of purification ; for in this instance the light was immediately produced in a perfect state within a few feet of the gasometer. With regard to the comparative expense, it was stated that 1,000 cubic feet of gas manufactured by this process, could be supplied to the public for about one-third the price now charged by the coal-gas companies. If it should be proved that the mixture of pure hydrogen with the illuminating gas obtained from bituminous matter can be effected without diminishing the intensity of the light, the decomposition of water will cease to be a mere experiment for the amusement of the curious, and become a source of important and permanent benefit to society.

ON THE RELATIVE COMBINATIONS OF THE CONSTITUENTS OF CAST IRON, STEEL, AND MALLEABLE IRON.

By Dr. Charles Schafhaeutl, of Munich.

The author showed, that the purest carbon contained and retained hydrogen, and sometimes azote, even at the highest temperatures, and parted with neither of them, nor were its own internal and external properties altered, except when it attacked the crucible, and combined instead with oxygen, or aluminum, or silicon. He affirmed, that we possessed no certain method of procuring pure carbon in the isolated state, and that what we considered to be pure carbon was always, more or less, in the state of *carburet.* The author described a new method of obtaining graphite—viz., by running fluid puddling slag, or silicates of iron and manganese, over fragments of pit coal. After cooling, the surface of the slag is always found to be altered, and to be covered with a very easily separable layer of graphite, not only where the slag actually touches the coal, but even where it comes in contact with the smoke evolved from the coal. The formation of graphite commences at a temperature lower than 1500° Fahr., and reaches its highest point not much exceeding 2000°. Two different sorts of graphite were produced in this way ; one, which he marked graphite (A), was in elastic scales, of the thickness of writing paper, with a rather dull metallic appearance. The graphite marked (B) was of the thickness of gold leaf, and extremely light and unctuous to the touch. He found, that all sorts of graphite lost their

unctuosity and bright appearance by exposing them to the action of concentrated hydro-fluoric acid gas. Graphite (B) was found to consist of—

Protoxide of iron	18.6000
Silica	7.6200

probably mechanically, but equally and invisibly intermixed with,

Carbon	70.3421
Silicon	3.0744
Loss	00.3635
	100.0000

Graphite (A) gave—

4.93	Silicon.
9.50	Iron.
85.45	Carbon.
00.12	Loss.
100.00.	

The quantity of oxides of iron and silica had been ascertained by heating the specimens first with acids and caustic leys; the quantity of carbon, by burning the specimens with chromate of lead and chlorate of potash; and the silicon, by melting the powders with carbonate of soda in a platinum crucible. He considered, therefore, the graphite to be a *carburet of silicon* and iron; and showed, by heating in a *peculiar* way the remainders, left after the solution of iron in chlorohydric acid of a certain specific gravity, that the chemical composition of cast iron, in its two distinct species of grey and white cast iron, had direct relation to the two specimens of graphite, and in all probability were derived from similar origin, as indicated in the following table:—

Graphite (*B*).

Iron Silicon	Oxygen.	Silicate of iron.
Silicon Carbon	Carburet of silicon.	

Grey Cast Iron.

Iron Silicon (Aluminum)	Silicet and aluminet of iron.
Carbon Silicon	Carburet of iron.

Graphite (*A*).

Iron Carbon	Carburet of iron.
Carbon Silicon	Carburet of silicon.

White Cast Iron.

Iron Carbon Azote	Carburet of iron.
Silicon Carbon	Carburet of silicon.

It was farther shown, that all grey iron, produced by heated air as well as by cold air, left a greyish white residue behind, after treating it with chlorohydric acid of a certain specific gravity. This remainder, acted upon with caustic ammonia, evolved very rapidly pure hydrogen gas, and alumina afterwards was found in the solution with a little silica. The presence of aluminum in its metallic state, after having been treated with acid, as well as the absence of all *azote*, seemed to be one principal feature *of grey iron of France* as well as of England; as, on the contrary, carbon, hydrogen, and *azote* are always present in the remainders of *white iron*, which remainders appear invariably of a brownish colour; and that azote was a constituent of steel as well as of wrought iron. Farther, it was explained, that silicon generally was combined with *carbon*, and dissolved in the carburets of iron, and that it was extremely difficult to produce an alloy of iron with silicon alone, without the presence of a little carbon, aluminum, and other similar bodies. He found the molecules of all iron of a similar form, belonging to the cubical system, and the largest not exceeding 0.0000633 of an inch in diameter, and that particularly upon the arrangement of these molecules depends, in a great measure, the different appearance of the different kinds. He denied that any graphite scales were to be seen in grey cast iron; yet, that under a magnifying glass what appeared to the naked eye graphite scales, were really surfaces and planes of crystallization, composed of pentagonal planes not wider in the smallest diameter than 0.000355 of an inch, and composed of the before-mentioned smallest or primitive iron molecules. According to his statement, the molecules of the iron are arranged in the grey cast iron in the most regular form, having all their surfaces in one plane. The most equal distribution of molecules appeared in hardened steel; collecting in fascicular aggregation in soft steel, and being loose and longitudinally arranged in wrought iron. He stated that pure iron could not be welded; that the welding power of iron depended on its alloy with the carburet of silicon, and also that

the good and various qualities of all the wrought irons depended on the alloys of pure iron with other metallic bodies; and that the presence of most of the electro-negative metals had been generally overlooked in the existing analysis of iron. The presence of arsenic in Swedish steel, when forged red-hot, could be ascertained by its smell, as well as in the Low Moor iron. The usual solution of iron under analysis, in order to separate those metals from the iron, must be, for the necessary correction, divided into two parts,—one to be treated with a current of sulphuretted hydrogen, the other part *dropped* into sulphydrate of ammonia, and carefully digested. A small quantity of silica was more difficult to separate from a large quantity of iron than generally seemed to be believed; and the real amount of carbon could *only* be ascertained by Berzelius's method of burning iron in a current of oxygen, or mixed with chlorate of potash and chromate of lead in a glass tube, used first by Berzelius for analysis of organic bodies. The author maintained that steel was an entirely mechanical production of the forge hammer, which tore the molecules of certain species of white cast iron out of their original position, into which the forces of attraction in respect to the centres, as well as to the position of the molecules, had arranged those molecules by the slow action of heat. Steel, as it came out of the converting furnace or the crucible, was nothing more nor less than white cast iron, of which Indian steel, called Wootz, was the fairest specimen. The author finally gave an analysis of two specimens of cast iron and one of steel. The first specimen was French grey iron, from Vienne, Department de l'Isere, obtained from a mixture of pea-iron-ore with red hematite, by means of coal from Rive de Gier and heated air, specific gravity 6.898. The second iron was Welsh iron, from the tin-plate manufactory of the Maesteg ironworks, near Neath, in South Wales, obtained from a mixture of clay iron-stone and Cumberland red ore, by means of coke and heated air. It was silvery white, without signs of crystallization; specific gravity 7.467. The third specimen was a fragment of a razor, forged in the author's presence, in the workshop of Mr. Rodgers, of Sheffield, of the specific gravity of 7 92.

	Grey French Iron.	White Welsh Iron.	Steel.
Silicon	4.86430	1.00867	0.52043
Aluminum	1.00738	0.08571	0.00000
Manganese	0.75130	traces.	1.92000
Arsenic	0.00000	0.00000	0.93400
Antimony	0.00000	1.59710	0.12100
Tin	0.00030	0.00000	traces.
Phosphorus	0.54000	0.08553	0.00000
Sulphur	0.17740	0.32018	1.00200
Azote	0.00000	0.76371	0.18310
Carbon	3.38000	4.30000	1.42800
Iron	89.00740	91.52282	93.79765
Loss	00.27222	00.31428	0.09382
	100.00000	100.00000	100.00000

Several gentlemen, among whom were some connected with the iron trade, expressed a high sense of the value of this communication, from which it appeared that the peculiarities of Swedish iron, in a great degree, depended on the presence of arsenic, and those of Russian iron on the presence of phosphorus.

How to Kill Slugs.—Take a quantity of cabbage leaves, and either put them into a warm oven, or hold them before a fire, till they get quite soft; then rub them with unsalted butter, or any kind of fresh dripping, and lay them in the places infested with slugs. In a few hours the leaves will be found covered with slugs and snails, which may then be destroyed in any way the gardener may think fit.—*Gardener's Mag.*

Swedish Method of Preserving Apples.—They are skinned and quartered, and then half baked, which produces a disagreeable, shrivelled appearance; but they retain their flavour, and in that state can be kept any length of time.

GUIDE FOR YOUNG VIOLINISTS.

To the Editor of the Mechanic and Chemist

Sir,—I beg to enclose you a representation of a simple discovery made a few days ago, which may perhaps be of service to some of the readers of your valuable and entertaining publication. It is a belt made to go round the waist and buckle in front with an elastic strap affixed to the right hand side of it, to go round the arm and buckle, thereby keeping the arm close to the side, and affording a facility to the learner of the violin in acquiring the art of holding his bow.

I remain yours, &c.,

Apollo.

A, Waist belt.
B, Elastic arm strap.
C, The buckle of B.

THE CHEMIST.

ACIDS.

NO. XII.

Sulpho-cyanic Acid is most readily obtained by the following process, contrived by Vogel:—Mix equal weights of flowers of sulphur and powdered ferrocyanate of potassa, and keep the mixture melted in a flask for half an hour; when cold, reduce the mass to powder, and digest it in water, filter the solution, and add a sufficiency of liquid potassa to throw down the iron held in solution. The liquid thus obtained is a solution of the sulpho-cyanuret of potassium, from which liquid sulpho-cyanic acid may be obtained by distillation with phosphoric or sulphuric acid. Thus procured, it is of a pinkish hue, with an acetic odour, and is characterized by the peculiar blood-red colour which it produces when mixed with persulphate of iron. It reddens litmus, and neutralizes the alkalies, and forms a white insoluble salt with protoxide of copper. When concentrated, its specific gravity is 1.022. It boils at 217°, and at 15° it crystallizes. Most of its salts are soluble in alcohol. Its combinations are called *sulpho-cyanates.*

Sulpho-napthalic Acid.—It can be obtained pure by the following process:—Napthaline, fused with half its weight of sulphuric acid on cooling, forms a red crystalline compound, soluble in water; carbonate of baryta, added to its solution, forms sulphate and sulpho-napthalate of baryta, the former insoluble, but the latter soluble; its solution is to be filtered off, and sulphuric acid to be added to it in sufficient quantity to precipitate the baryta. An aqueous solution of sulpho-napthalic acid is thus obtained, of a bitter acid taste, and powerfully reddening litmus; concentrated by evaporation, it becomes brown, thick, and ultimately solid, and very deliquescent. By renewed heat it melts and chars, but does not inflame, and ultimately gives sulphuric and sulphurous acid vapours, and leaves charcoal. Its salts are termed *sulpho-napthalates.*

Tartaric Acid is generally obtained from the bitartrate of potassa. Mix 100 parts of this salt in fine powder with 30 of powdered chalk, and gradually throw the mixture into ten times its weight of boiling water; when the liquor has cooled, pour the whole upon a linen strainer, and wash the white powder which remains with cold water; this is a tartrate of lime; diffuse it through a sufficient quantity of water, add sulphuric acid equal in weight to the chalk employed, and occasionally stir the mixture during twenty-four hours, then filter, and carefully evaporate the liquor to about one-fourth its original bulk; filter again, and evaporate with much care nearly to dryness; redissolve the dry mass in about six times its weight in water; render it clean by filtration; evaporate slowly to the consistence of syrup, and set it aside to crystallize. By two or three successive solutions and tartarizations, tartaric acid will be obtained in colourless crystals, soluble in six parts of water at 60°. They are rectangular prisms, terminated by dihedral or four-sided pyramidal summits. Their specific gravity is 1.600. They fuse at a temperature a little above 212° into a fluid which boils at 250°, and leave a semi-transparent mass on cooling. Its salts are called *tartrates.*

To the Editor of the Mechanic and Chemist.

Sir,—In looking over your last number but one, I find your correspondent, "A Taylor," has fallen into a slight error in stating that gold leaf is impervious to the passage of light. Any person may prove that light passes through it; by holding a piece of common gold leaf up to the light, they will see it passes through, of a bluish green colour. Hoping that "A. T." will not take this interference offensively,

I remain yours, &c.,

J. Mitchell.

MISCELLANEA.

Animalcules.—By the discoveries of the microscope we find, that in a single drop of water there are myriads of animals, creatures of which it would require nearly a thousand millions to form a cubic inch, all recreating and executing their various functions and evolutions with as much rapidity and apparent facility, as if the range afforded them were as boundless as the ocean. Animalcules bear no resemblance whatever to animals which we see with the naked eye. They are of all imaginable shapes; their figures resemble round balls, ovals, eels, snakes, corkscrews, funnels, tops, cylinders, pitchers, wheels, flasks, purses, semicircles, kidneys, dots with tails, tobacco-pipes, flowers, branches of trees, egg-cups, and some have the appearance of a tulip with a flowery bulb and stalk. The apparently incalculable number of forms of animalcules is not more puzzling to the investigator than their assumption of new forms. Most creatures that we know of produce young after their kind, either at once bringing forth their progeny into life, or through the medium of eggs, but always producing young resembling themselves in figure. Animalcules, however, have generally a different way of coming into existence. One class propagates by spontaneous scissure, a division of their bodies into two or more portions, each one forming a new creature, which, on its arrival at maturity, pursues the same course. In thus cutting themselves in pieces, they are very capricious in their fancy; sometimes they divide straight across, sometimes lengthwise, and sometimes diagonally, and what forms the chief difficulty in understanding them, the pieces so separated do not resemble the original: an animalcule resembling a ball will give birth (if this word can be properly applied) to a number of triangles. Another class of animalcules propagate by the distribution of the internal substance of the parent, of which nothing is left but the envelop, soon to be dissolved; a third class are produced from germs shooting out from the sides of the parent; and most likely there are many other ways by which they come into life, of which naturalists have yet no knowledge.—*The Naturalist.*

Value of Machinery.—The creation of employment among ourselves by the cheapness of cotton goods produced by machinery, is not to be considered as a mere change from the labour of India to the labour of England. It is a creation of employment, operating just in the same manner as the machinery did for printing books. The Indian, it is true, no longer sends us his calicoes and his coloured stuffs; we make them ourselves. But he sends us forty times the amount of raw cotton that he sent when the machinery was first set up. In 1781 we imported five million pounds of cotton wool. In 1828 we imported two hundred and ten million pounds—enough to make twelve hundred and sixty million yards of cloth—which is about two yards a-piece for every human being in the world. The workman on the banks of the Ganges (the great river of India) is no longer weaving calicoes for us, in his loom of reeds under the shade of a mango tree; but he is gathering for us forty times as much cotton as he gathered before, and making forty times as much indigo for us to colour it with. The export of cotton has made such a demand upon the Indian power of labour, that even the people of Hindostan, adopting European contrivances, have introduced machinery to pack the cotton. Bishop Heber says, that he was frequently interested by seeing, at Bombay, immense bales of cotton lying on the piers; and the ingenious screw, by which an astonishing quantity is pressed into the canvass bags. The Chinese, on the contrary, from the want of these contrivances, sell their cotton to us at much less profit; for they pack it so loosely, that it occupies three times the bulk of the Indian cotton, and the freight costs twelve times the price to which it might be reduced by mechanical skill. When the Chinese acquire the knowledge from other nations, which their institutions now shut out, they will know the value of mechanical skill, in preference to unassisted manual labour.—*Results of Machinery.*

Pins.—The pin was not known in England till towards the middle or latter end of the reign of Henry VIII; the ladies till then using ribbons, loops, skewers made of wood, of brass, silver, or gold. At first the pin was so ill made, that in the 44th year of the king, Parliament enacted that none should be sold "unless they be double-headed, and have the heades soudered fast to the shanke of the pynne."

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Dec. 26, R. A. Ogilvie, Esq., on Insects. At half-past eight.

St. Pancras Literary and Scientific Institution, Colosseum House, New-road. Monday, Dec. 31. Quarterly Meeting. At half-past eight.

QUERIES.

A recipe of the preparation of a cheap ink, of any dark colour, to mark calico, that will resist the power of an alkali when boiled in water, and the method of using the same. L. D.

How square glass shades are made, the composition on the edges (if it is composition), and gilt afterwards; and likewise the gold enamelling on glass, how the lines are ruled? The above shades are those used for clocks, striped birds, and other fancy articles. T. H. L. L.

1. What change takes place in the elementary parts of animal and vegetable substances, when submitted to the action of the ordinary bleaching agents, as chlorine, &c.?

2. Whether any difference exists between the basis of the colouring matter of animal substances and that of vegetables?

3. The easiest way to prepare naptha, or pyrolixic spirit, on a small scale, from the wood liquor of the mordant makers?

4. I have lately heard that bread may be made, and has been made from sawdust of wood, or in other words, from wood itself, the bread being highly nutritious; is there any truth in this, and if so, in what book can I see the process described? AN AMATEUR CHEMIST.

ANSWERS TO QUERIES.

"R H." can have a working model (if required to scale, and embracing full detail) made at a moderate price, by applying (if by letter post paid) to J. T., 19, New Compton-street, St. Giles.

How to make the Drummond light.—The Drummond, or lime light, is made by throwing the flame produced by the combustion of the oxygen and hydrogen gases on a small piece of lime. It is the same as the Koniaphostic light, lately exhibited at the Surrey Zoological Gardens.

How to make differently coloured Stains for Paper.—Paper may be stained as follows:—

Blue, by a solution of indigo in sulphuric acid. One part of indigo is to be digested in four parts of sulphuric acid for 24 hours; to the solution, one part of dry carbonate of potass is to be added, and then it is to be diluted with eight parts of water.

Yellow, with a strong decoction of either quercitron or fustic; the paper must be washed with a solution of alum in water before it is washed with the decoction; two ounces of either quercitron or fustic, to one pint and a half of water, to be boiled down to a pint.

Red, with a decoction of either Brazil wood or cochineal; with the latter the colour is finest. The paper must be sponged over with a solution of pearlash before using the Brazil wood, and with a solution of nitro-muriate of tin before using the cochineal.

Green, by a mixture of the blue and yellow stains.

Orange, by a decoction of turmeric; the paper to be previously washed over with a solution of pearlash.

Purple, with a decoction of logwood, the paper to be previously washed over with a solution of alum.

The Bude Light is formed by passing a stream of oxygen gas through the centre of the flame of an Argand lamp.

Which is the lightest, silk or bladder, for a small balloon?—Bladder, I should say. The prepared turkey's maw is generally used for the purpose. J. MITCHELL.

To Polish Glass.—Glass is polished by rubbing it with a leather dressed with putty powder (oxide of tin), wetted from time to time, when it works too stiffly. The leather is generally attached to a piece of wood, whose shape varies according to the work it has to perform.

To make Green Ink.—"R. S. L." According to Klaproth, a fine green ink may be prepared by boiling a mixture of two parts of verdigris in eight parts of water, with one of cream of tartar, till the total bulk be reduced to one half. The solution must then be poured through a cloth, cooled and bottled for use.

Etching on Ivory.—The ivory must be first covered with wax, or, what is better, the following composition:—2 ounces of asphalt, 1 ounce of white rosin, half an ounce of white wax; either of the grounds being applied, the figure or pattern must be traced through it; the surface must then be covered with strong sulphuric or muriatic acid: after the operation the wax may be washed away with turpentine.

To Dye Ivory Blue.—When ivory is kept immersed for a longer or shorter time in dilute solution of indigo (the sulphate) partly saturated with potass, it assumes a blue tint of greater or less intensity. JUVENILE ENTERTAINER.

TO CORRESPONDENTS.

F. V. E.—*The force which causes rockets to ascend is not "the resistance of the air against the flame," but the upward pressure caused by the combustion. Let a hollow cylinder, closed at each end, be filled with steam, or condensed air; if an aperture, equal to one-tenth of the whole area of the base, be then made at one end, the pressure at that end will be reduced one-tenth, and the cylinder will be impelled in a direction contrary to that of the escaping current, with a force equal to the difference of the entire base, and the remaining part of the perforated one. This is the principle upon which Hiero constructed the first recorded steam-engine. If a continual supply of elastic fluid be produced, and one of the bases be entirely removed (as it is in rockets, and other similar fireworks), the whole pressure upon the remaining base will be effective in imparting motion to the projectile, whether it move in a resisting medium, or* in vacuo.—*His remarks upon multiplication will be noticed in our next.*

A. W. M.—*Small iron articles may be tinned by cleaning them with a file or scraper, and then dipping them into a solution of sal ammoniac, and afterwards into melted tin. When they are taken out, they will be covered with a coating of tin.*

Alpha *will perceive that we have availed ourselves of the various extracts he has sent us; some are delayed for the purpose of adding farther explanations, but will ultimately appear.*

ERRATA.—Line 49, page 107, column 1, for "are," read *is;* line 55, page 107, col. 2, for "contains," read *combines with.*

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THE

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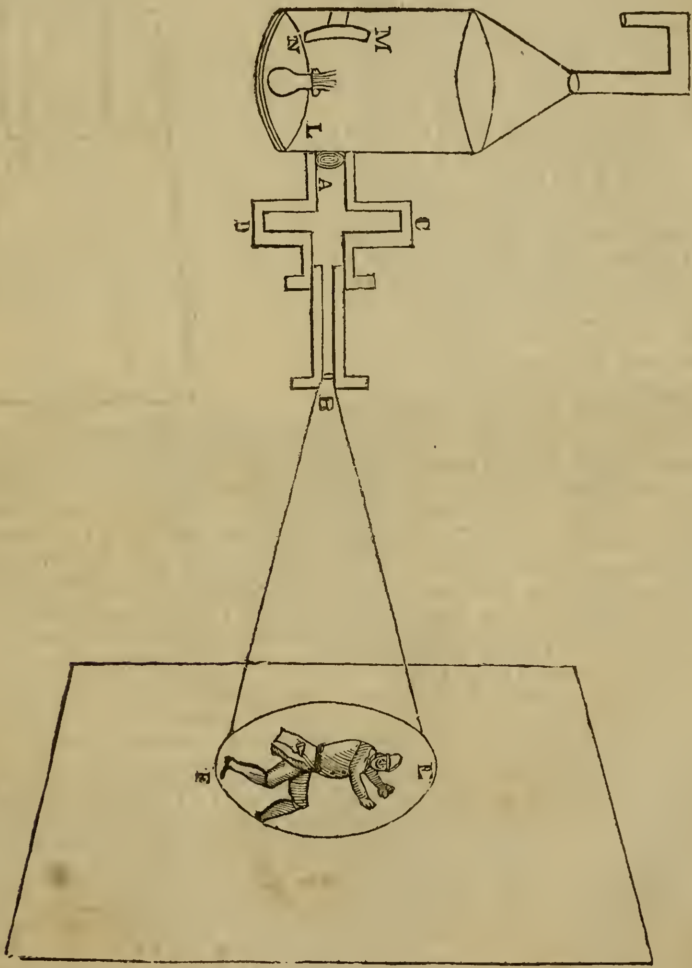
THE MAGIC LANTERN.

Fig 2.



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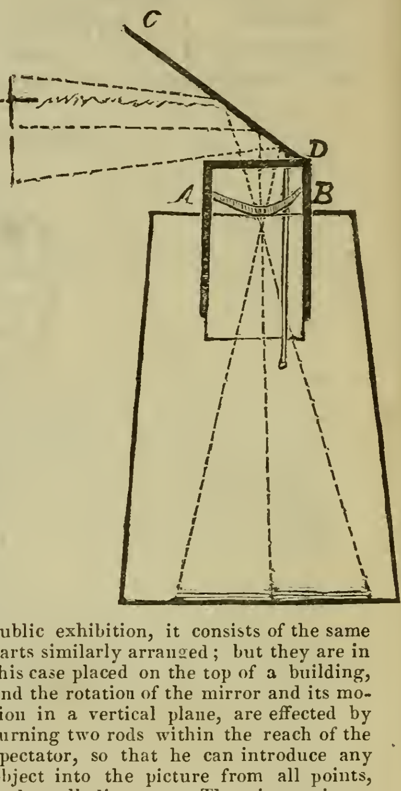
OPTICAL INSTRUMENTS.

NO. V.

The camera obscura is the name of an amusing and useful optical instrument, invented by the celebrated Baptista Porta. In its original state, it is nothing more than a dark room with an opening in the window shutter, in which is placed a convex lens of one or more feet focal length. If a sheet of white paper be held perpendicularly behind the lens, and passed through its focus, there will be painted upon it an accurate picture of all the objects seen from the window, in which the trees and clouds will appear to move in the wind, and all living objects to display the same movements and gestures which they exhibit to the eye. The perfect resemblance of this picture to nature, astonishes and delights everyone, however often he may have seen it. The image is, of course, inverted; but if we look over the top of the paper, it will be seen as if it were erect. The ground on which the picture is received should be hollow, and part of a sphere, whose radius is the focal distance of the convex lens. It is customary, therefore, to make it of the whitest plaster of Paris, with as smooth and accurate a surface as possible. In order to exhibit the picture to several spectators at once; and to enable any person to see it, it is desirable that the image should be formed upon a horizontal table. This may be done by means of a metallic mirror placed at an angle of 45° to the refracted rays, which will reflect the picture upon the whole ground lying horizontally; or, as in the portable camera obscura, it may be reflected upwards by a mirror, and received on the lower side of a plate of ground glass, with its rough side uppermost, upon which the picture may be copied with a fine sharp-pointed pencil. A very convenient portable camera obscura for drawing landscapes or other objects, is shown in fig. 1, where A is a meniscus lens, with its concave side uppermost; and the radius of its convex surface being to the radius of its concave surface as 5 to 8; and C D, a plain metallic speculum, inclined to an angle of 45° to the horizon, so as to reflect the landscape downwards through the lens, A B. The draughtsman introduces his head through an opening in one side, and his hand with a pencil through another opening, made in such a manner as to allow no light to fall upon the picture, which is exhibited on the paper at E F. The tube containing the mirror and lens can be turned round by a rod within, and the inclination of the mirror changed so as to introduce objects in any part of the horizon. When the camera is intended for

Fig. 1.



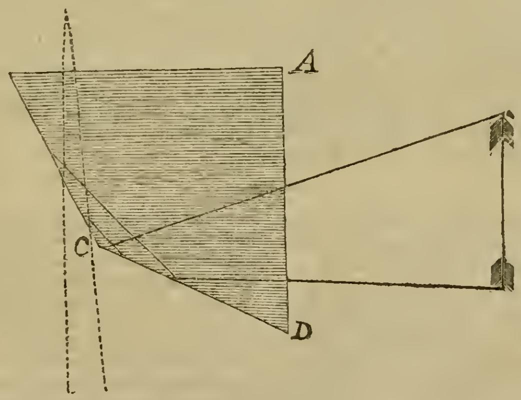
public exhibition, it consists of the same parts similarly arranged; but they are in this case placed on the top of a building, and the rotation of the mirror and its motion in a vertical plane, are effected by turning two rods within the reach of the spectator, so that he can introduce any object into the picture from all points, and at all distances. The picture is received on a table, whose surface is made of stucco, and of the same radius as the lens, and this surface is made to rise and fall to accommodate it to the change of focus produced by objects at different distances. A camera which throws the image down upon a horizontal surface, may be made without any mirrors, by using any of the lenticular prisms, D E F, G H I, M L N, and P Q R (page 41), where the objects are extremely near. The convex surfaces of these prisms converge the rays which are reflected to their focus by the flat faces, D E, G H L N, and P Q; these lenticular prisms may be formed by cementing plano-convex or concave lenses on the faces A B, B C, of the rectangular prism, A B C, or the convex lens may be placed near to A B. A modification of the

camera, called the megascope, is intended for taking magnified drawings of small objects placed near the lens. In this case, the distance of the image behind the lens is greater than the distance of the object before it. By altering the distance of the object, the size of the image may be reduced or enlarged. The hemispherical lens, L M N (page 41), is particularly adapted for the megascope.

The Magic Lantern—an invention of Kircher (a representation of which is given in fig. 2, front page), where L is a lamp, with a powerful Argand burner, placed in a dark lantern. On one side of the lantern is a concave mirror, M N, the vertex of which is opposite to the centre of the flame which is placed in its focus. In the opposite side of the lantern is fixed a tube, A B, containing a hemispherical illuminating lens, A, and a convex lens, B; between A and B, the diameter of the tube is increased for the purpose of allowing sliders to be introduced through the slit, C D. These sliders contain four and five pictures, each painted and highly coloured, with transparent varnishes; and by sliding them through C D, any of the objects may be introduced into the axis of the tube, and between the two lenses, A B. The light of the lamp, L, increased by the light reflected from the mirror falling upon the lens, A, is concentrated by it upon the picture in the slider; and this picture being in one of the conjugate foci of the lens, B, an enlarged image of it will be painted on a white cloth, or on a screen of white paper, E F, standing or suspended perpendicularly. The distance of the lens, B, from the object or the slider, may be increased or diminished by pulling out or pushing in the tube, B; so that a distinct picture of the object may be formed of any size and of any distance from B within moderate limits. If the screen, E F, be made of fine semi-transparent silver paper, or fine muslin properly prepared, the image may be distinctly seen by a spectator on the other side of the screen. The phantasmagoria is nothing more than a magic lantern, in which the images are received on a transparent screen, which is fixed in view of the spectator. The magic lantern mounted upon wheels is made to recede from, or approach to, the screen; so that the picture on the screen expands to a gigantic size, or contracts into an invisible object, or mere luminous spot.

Camera Lucida—an invention of Dr. Wollaston, and much used for drawing landscapes, delineating objects of natural history, and copying and reducing drawings. Dr. Wollaston's form of the instrument is shown in fig. 3, where A B C D

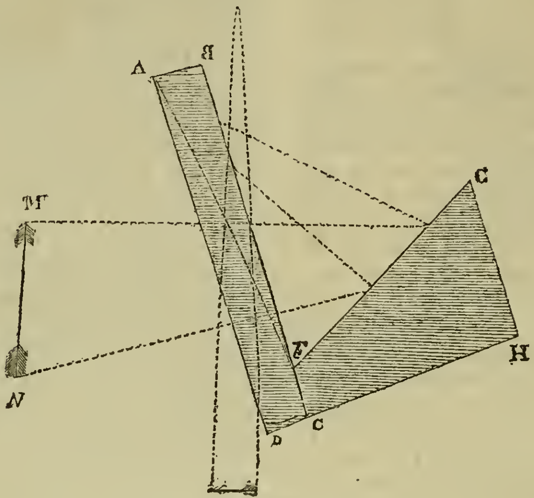
Fig. 3,



is a glass prism, the angle B A D being 90°, A D C 67°, and D C B 135°. The rays proceeding from any object, M N, after being reflected by the faces, D C, C B, to the eye at E, placed above the angle, B, the observer will see an image, *m n*, of the object, M N, projected upon a piece of paper at *m n*. If the eye be now brought down closely to the angle, B, so that it at the same time sees into the prism with one half of the pupil, and past the angle, B, with the other half, it will obtain a distinct vision of the image, *m n*, and also see the paper and the point of the pencil. The draughtsman has, therefore, only to trace the outline of the image upon the paper, the image being seen with half the pupil, and the paper and pencil with the other

half. Many persons have acquired the art of using the instrument with great facility, while others have entirely failed. In examining the causes of this failure, Professor Amici, of Modena, succeeded in removing them, and has proposed various forms of the instrument, free from the defects of Dr. Wollaston's. The one which M. Amici thinks the best is shown in fig. 4, where A B C D is a piece of thick

Fig. 4.



parallel glass; F G H C, a metallic mirror, whose face, F G, is highly polished, and inclined 45° to B C. Rays from an object, M N, after passing through the glass, A B C D, are reflected from F G, and afterwards from the face, B C, of the glass to the eye at E, by which the object, M N, is seen at *m n*, where the paper is placed. The pencil and the paper are readily seen through the plain glass, A B C D. In order to make the two faces of the glass, A D, B C, perfectly parallel, M. Amici forms a triangular prism of glass, and cuts it through the middle; he then joins the two prisms, or halves, A D C, C A B, so as to form a parallel plate, and by slightly burning round the prisms, he can easily find the position in which the two faces are perfectly parallel.

A. D. M.

SUMMARY OF THE EFFECTS OF VARIOUS RAILWAYS ON THE AMOUNT OF INTERCOURSE.

By referring to our notes, A and B, it will be seen that on the Stockton and Darlington line, the passenger traffic, prior to the establishment of the railway, amouted only to 4000 persons in the year: it now exceeds 16,000. On the Bolton line the average weekly number of passengers is 2500; whereas the number of coach journeys out and in per week, which the railway has superseded, amounted only to twenty-eight, carrying, perhaps, on a weekly average, about 280 or 300 persons. On the Newcastle and Carlisle road, prior to the railway, the whole number of persons the public coaches were licensed to carry in a week, was 343; or, both ways, 686: now the average daily number of passengers by the railway, for the whole length, viz., $57\frac{1}{2}$ miles, is 228, or 1596 in the week. The number of passengers on the Dundee and Newtyle line exceeds, at this time, 50,000 annually: the estimated number of persons who performed the same journey previous to the opening of the railway, having been 4000. Previous to the opening of the railway between Liverpool and Manchester, there were about 400 passengers per day, or 146,000 a-year, travelling between those places by coaches; whereas the present number, by railway alone, exceeds 500,000. In foreign countries the results arising from the same causes are equally striking. The number of persons who usually passed

by the road between Brussels and Antwerp, was 75,000 in the year; but since the railroad has been opened from the former place to Malines, it has increased to 500,000! and, since it was carried all through to Antwerp, the number has exceeded a million. The opening of a branch from Malines to Termonde, appears to have added 200,000 to the latter number; so that the passenger traffic of that railroad, superseding a road traffic of only 75,000 persons, now amounts to 1,200,000. It is remarkable that on this, as on most other railroads, the greater number of passengers are those who travel short distances, being as two to one compared with those who go the whole distance. This appears from a statement read by Mr. Loch, before the statistical society of Manchester, showing that between April 30th and August 15th, 1836, 122,416 persons travelled the whole distance, and 244,834 short distances, chiefly to and from Malines. He farther states, that "nearly one-third of the whole revenue of the railway is derived from travelling to and from Malines, and paying a fare of about sixty-six centimes, or nearly sixpence sterling." On the same authority we learn another fact most deserving of attention, in calculating the probable success of a railroad in such a country as Ireland, viz. that nearly three-fifths of the whole revenue of the company are derived from passengers of the lower class, paying a very low fare.—*Irish Railway Report.*

REVIEWS.

The Book of the United Kingdom. Written by Uncle John, for his Youthful Friends. Pp. 475. Darton and Clark.

TO OUR YOUNGER READERS.

Uncle John! Uncle John! Who is Uncle John? Why, if we may judge by his writings, he is akin to the juveniles' venerable and worthy friend, Peter Parley. This said Uncle John has just sent us a book, and asks us for our opinion of it; and our reply to Uncle John is, that if all he says of himself be true, he must be a mighty clever fellow,—if he be not, it surely must be his own fault, as, according to his own statement, he has had opportunities of obtaining knowledge which comparatively few persons possess. Upon opening his preface, we are saluted with the following :—

"I have been much *abroad,* but am always at *home* when I talk of what I have seen. And I hope you will find me at home, my little friends; indeed, I assure you I mean to make myself so, and you have only to tell me what part of my travels you would like me to detail to you. I have been all over Europe, Asia, Africa, and America; been up in a balloon, and down in a diving-bell; stood on the top of Chimboraza, and been to the bottom of the deepest coal mine."

Now we doubt not our young readers will agree with us, that this is saying a great deal; but when they come to see Uncle John's book, and to read the account of his various travels, adventures, and so forth, they will readily conclude that no one but an eye-witness could have given so clear and straight-forward a narrative. We have hastily glanced through the volume—which by the way is most prettily got up—and pitch upon the following as an illustration of the sentiments we have just advanced :—

"An ascent of Skiddaw was determined on by a party of whom I was one. The mountain is 3,500 feet from the level of the sea, and we began to ascend from Keswick. As we ascended, Derwent Water dwindled to the size of a pond, while the grandeur of its amphitheatre was increased by new ranges of dark mountains sublime from accumulation. We soon lost all traces of the flocks that were scattered over these tremendous wilds, and the guide conducted us by many curvings among the heathy hills and hollows of the mountains. The mountain soon again shut out all prospects but its own valleys and precipices, covered with various shades of turf, moss, and heath, of which a dark purple was the prevailing hue. Deep chasms and torrents surrounded us, foaming and shining amidst the dark rock. As we ascended, the air became very thin, and the steeps more difficnlt of ascent. About a mile from the summit the way was, indeed, dreadfully sublime, lying for nearly a mile along the edge of a precipice that gaped into a glen within the heart of Skiddaw, and neither a hill nor a bush interrupted its length through the whole distance. The ridgy steeps of Saddleback formed the opposite boundary of the glen; and although at a considerable distance, had, from the height of the two mountains, such an appearance of vicinity, that it almost seemed as if we could spring to its side. The hill in this part rose so close, as scarcely to allow a ledge wide enough for a single horse. After this the ascent appeared easy and secure.

Passing the skirts of the two points of Skiddaw which are nearest to Derwent

Water, we approached the third and loftiest, and then perceived that their steep sides, together with the ridges which connect them, were entirely covered, near the summit, with a whitish shivered slate, which threatened to slide down them with every gust of wind; the broken state of this slate makes the present summit seem like the ruin of others. The prospects that now burst upon us at every step were grand beyond description. At last we stood on a pinnacle commanding the whole dome of the sky, and the prospects below, each of which had before been considered separately as a grand scene, were now minute parts of the same landscape. On the north, in the grey horizon, might be discovered the Scottish mountains. The Solway appeared surprisingly near us, though fifty miles distant, and the guide said, that on a bright day the shipping might be clearly distinguished. Nearly in the same direction the Cheviot hills dawned feebly beyond Northumberland. Our sight now spanned the narrowest part of England, looking from the Irish Channel on one side, to the German ocean on the other; the latter was, however, so far off as to be discernible only as a mist. All individual dignity was now lost in the immensity of the whole, and every variety of character was overpowered by that of astonishing and awful grandeur.

The air on this summit was boisterous, intensely cold, and difficult to be respired, though the atmosphere below was warm and serene. In the descent it was interesting to observe each mountain below gradually re-assuming its dignity, the two lakes expanding into spacious surfaces, the many little vallies that sloped upwards from their margins recovering their variegated tints of cultivated lands, the cattle re-appearing upon the meadows, and the woody promontories changing from smooth patches of shade into richly tufted summits. About a mile from the top a great difference was perceptible in the climate, which became comparatively warm, and the summer hum of bees was again heard on the purple heath.

About three miles to the east of Skiddaw is Saddleback, a mountain 3,324 feet in height. It obtained its name from its shape, resembling a saddle. The same party who had the day before made the ascent of Skiddaw, determined to gain the summit of this mountain also. We started early in the morning, just as the sun was rising behind it; the base of this mountain is broken into a little world of mountains, green with cultivation; its north-west skirts unite with the declivities of Skiddaw, but its southern face is furrowed by several hideous chasms, and its summit is in many parts frightful and desolate. It appears to have been in a volcanic state at one time; and a lake on the upper part, called Threlkeld Tarn, whose bed is apparently the solid rock, is supposed, from the lava and burnt stones found in its neighbourhood, to have been a crater. This cavity is several acres in extent, and said to be so deeply situated in the bosom of the rock, that the sun never shines upon it. Its waters appear black, and are as smooth as glass. The views from the summit are exceedingly extensive; but those immediately under the eye, on the mountain itself, are so tremendous and appalling, that few persons have sufficient resolution to experience the emotions which these awful scenes inspire, and they are, therefore, but seldom visited. One of the points of the summit juts out between two gulphs, that seem to be more than 800 feet deep, having their sides craggy and barren, and their bottoms paved with broken rocks of various hideous forms and dimensions.

While we were enjoying ourselves on the top of this mountain with the grandeur of the scenery, our guide began to warn us of a coming storm, and advised us to quit the mountain. We saw no immediate signs of such an occurrence, and deferred our stay till the clouds advanced with accelerated speed, and the hollow blast sounded among the hills and dells which lay below, and seemed to fly from the approaching darkness. The vapours rolled down the opposite valley, and seemed to tumble, in mighty sheets and volumes, from the brow of each mountain into the vale of Keswick, and over the lakes. While we admired this phenomenon the clouds below us gradually ascended, and we soon found the summit of the mountain totally surrounded, while we looked down on every side on an angry and tempestuous sea of clouds heaving its billows. We were rejoicing in this grand spectacle of nature, and thinking ourselves fortunate in having beheld so extraordinary an event, when, to our astonishment and confusion, a violent burst of thunder, engendered in the vapour below, stunned our senses, being repeated from every rock and down every dell, in horrid uproar; at the same time, from the agitation of the air, the mountain seemed to tremble at the explosion. The clouds were instantaneously illumined, and, from innumerable chasms, sent forth streams of lightning. Our guide lay upon the earth terrified, and in his ejaculations accusing

us of presumption and impiety. Danger made us serious; we had nowhere to flee to for safety; no place to cover our heads; to descend was to rush into the inflammable vapour, from whence our perils proceeded; to stay was equally hazardous, for now the clouds which had received such a concussion from the thunder, ascended higher and higher, enveloping the whole mountain, and letting fall a heavy shower of rain. We thought ourselves happy under this circumstance, as we perceived the storm turning north-west, and heard the next clap in the plain a mile from us. The echoes from the mountains which border Keswick Lake, from Newland, Borrowdale, and Lodore, were noble, and gave repetition to the thunder claps distinctly, though distant, after an intermission of several seconds of intense silence. The rain, which still increased, formed innumerable streams and cascades, which rushed from the crowns of Skiddaw, Saddleback, and Coswey Pike, with a mighty noise; but we were deprived of the beauty of these waterfalls by the intercepting vapour, which was not to be penetrated by the eye more than a few yards before us. We descended the hill, wet and fatigued, and were happy when we regained our inn, at Keswick, which we now esteemed a paradise."

Arithmetical Tables. By JAMES CHILD. London: Edwards, Ave Maria-lane; Darton and Harvey; Simpkin and Marshall.

A USEFUL little book, well adapted for schools; it contains several tables which are not found in ordinary books of arithmetic, and is executed with great accuracy—a quality peculiarly valuable in a work of this kind, intended not only for the purpose of education, but for practical reference. It has arrived at the twentieth edition, which sufficiently indicates the share of public favour it has obtained.

An Improved Me hod cf performing Commercial Calculations; representing the Science of Arithmetic in a New Light. By J. FELTON. London: Harvey and Darton, Gracechurch-street. 1839.

THE author's chief object appears to be the simplification and shortening of such calculations as are usually required in commercial transactions. Some examples of the abbreviated method compared with the work of the common system, are very striking; and we strongly recommend every accountant to peruse this valuable little volume, feeling confident that very few practical calculators will close the book without deriving at least some serviceable hints. It may be proper to remark, that the system taught in this work is not entirely new; many of the rules for abbreviation having been propounded by Wingate and others nearly a hundred years ago.

The Autobiography of Thomas Platter, a Schoolmaster of the Sixteenth Century. Pp. 106. Wertheim, Paternoster Row.

THIS little work is a translation from the German, and is rendered somewhat interesting by a series of wood illustrations, taken from the original prints.

MISCELLANEA.

Opening of an Ancient Barrow at Thornborough.—The following is given in the *Bucks Herald*:—On the farm belonging to the Duke of Buckingham and Chandos, near Thornborough Field, in this country, there are two ancient barrows, about 25 feet each in height. One of these has recently been opened under the direction of his Grace, and with the most gratifying results. The excavation was commenced last week by cutting a trench right down the centre; and by this operation it appeared that the barrow was composed of alternate layers of clay, sand, and mould, which continued until the trench was cut down to the original base—the level of the ground. On reaching this, a large and long layer of rough limestone presented itself, on whicb were found various bronze ornaments in an excellent state of preservation. Among them was a very curious lamp, beautifully shaped, formed of bronze, and totally different in pattern to any hitherto discovered—and so perfect, and taken up with such care, that the wick was actually to be seen in the lamp. Two large and elegant bronze jugs, a large dish, a bowl and the hilt of a sword, were also taken out without damage, as well as a small ornament of purest gold, with the figure of a Cupid, most elaborately and elegantly chased upon it. A large glass covered over with a thick piece of oaken planking was also discovered, but unfortunately, owing to the weight of the superincumbent earth, it was cracked and broken; but not so much so, but that within it were detected the ashes and fragments of the bones of the individual whose remains had been interred there for centuries. From the exquisite workmanship of these bronzes, and the hilt of a sword also found among the valuable and interesting relics of a by-gone age, it is conjectured that this was the *tumulus* of some person of great note and distinction. The excavation is proceeding, and no doubt but other valuable relics will be found, which, we trust, will afford the best means of judging of the date of the barrow; and thus add to the interest and value of these choice and peculiarly interesting specimens of an age, whose remoteness from the present time must be from 1400 to 1800 years!

Improvements in the Daguerreotype.—The French scientific men are very busy upon this discovery, in the proceedings of their Academy of Sciencces. Baron Seguier has exhibited an instrument constructed by himself, with ingenious modifications,—having for their objects diminution in size and weight, and simplification in other respects of the entire apparatus. M. Seguier expressed himself satisfied, that several of the conditions which have been announced as required for the success of the process, may be dispensed with; and stated his intention of devoting himself to a still frather simplification of the apparatus, so as, at least, to make it more portable, more easy of use, and less expensive. His improvements have likewise been directed to rendering the operations of photography practicable in the open country, even those delicate ones, which seem at present to require protection against too strong a light.—M. Arago also laid before the Academicians an objective glass, constructed with the view of *redressing* the image obtained in the Daguerreoytype, which is now presented *reversed*, —a circumstance that, in many cases, destroys the resemblance of places and monuments.

INSTITUTION.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street. Thursday, Jan. 2, William Ball, Esq., on the different Styles of the English Ballad. At half-past eight.

QUERIES.

If among your mathematical correspondents anyone will give the solution of the following equations, I shall be greatly indebted.

J. J. B.

$$\text{1st.}—x^2+1+\frac{x\sqrt{x}+\sqrt{x}}{2}=\frac{11x}{2}$$

$$\text{2nd.}—(x+1)\cdot(x^2+1)\cdot(x^3+1)=30x^3.$$

Where can I purchase asphalte in small quantities? I should prefer Claridge's.

W. Scott.

A, a pedestrian, is benighted on a large plain, and observes a light bearing directly north from him, and which light is distant from him exactly one mile. The light is carried by B, travelling directly east, at the rate of three miles an hour; but A, erroneously supposing it to be stationary, keeps continually travelling towards it at the rate of four miles an hour. How long will he travel before he comes up with B, and what will be the distances travelled by each of them, from the time the light appeared? Also, required the nature and construction of the curve described by A's route?

W. N.

ANSWERS TO QUERIES.

The Drummond Light.—"H. D. Chard."—The Drummond light is two jets of oxygen and hydrogen gases (mixed in the proportions for forming water) thrown on to a ball of lime put on to a wire, which is made to revolve by clock-work; by this means the lime becomes equally heated.

Th Bude or Gurney Light is an oil Argand lamp, with a jet of oxygen thrown up the centre. The commonest oil may be used; indeed the more smoky the oil burns in common, the better is the light. When the oxygen is made to pass through the flame, the oxygen strikes the nascent carbon and vapour of the oil, and produces an intense light. A reflector is generally used.

Juvenile Entertainer.

To make Green Ink.—Mix the solution of sulphate of indigo (the process for making it I have already described) with a decoction of French berries or fustic wood, and then dissolve gum-arabic in the mixture. J. Mitchell.

TO CORRESPONDENTS.

F. V. E.—"*Pounds, shillings, and pence cannot, from their nature, be multiplied by pounds, shillings, and pence, any more than an oak table can be made of deal boards;" so says our correspondent, and we agree with him, without any reservation. Multiplication is, in fact, nothing more than an abbreviated method of addition, in cases where the sums to be added are all alike and equal, or fractions of some given quantity; no operation of multiplication can, therefore, be performed without an abstract number, to prescribe the number of times the quantity to be multiplied is to be taken, or how many, and what fractional parts thereof are to be added together. To multiply a penny piece by half a crown, is in no degree more rational than multiplying the poker by the tongs, or a pound of common sense, by a yard of Treasury minutes. This is one of the many examples which might be adduced to show the value and the necessity of accurate language in all matters connected with mathematics. Those who have any knowledge of simple arithmetic, must be perfectly aware that one thing cannot be multiplied by another which represents no number. The meaning of those who speak of multiplying* 19*l.* 19*s.* 11¾*d. by* 19*l.* 19*s.* 11¾*d. (if they mean anything at all), is this:—"Multiply* 19*l.* 19*s.* 11¾*d. by* $19\frac{959}{960}$"*—a very different question from the former, and may easily be solved by the ordinary process of multiplication, thus;—*

$$19\frac{959}{960}=\frac{19199}{960}\times\frac{19199}{960}=\frac{368601601}{921680}=$$

$$£399.19.2—\frac{1}{960}.$$

T. P., W. W., *and* D. J., *shall be answered in our next.*

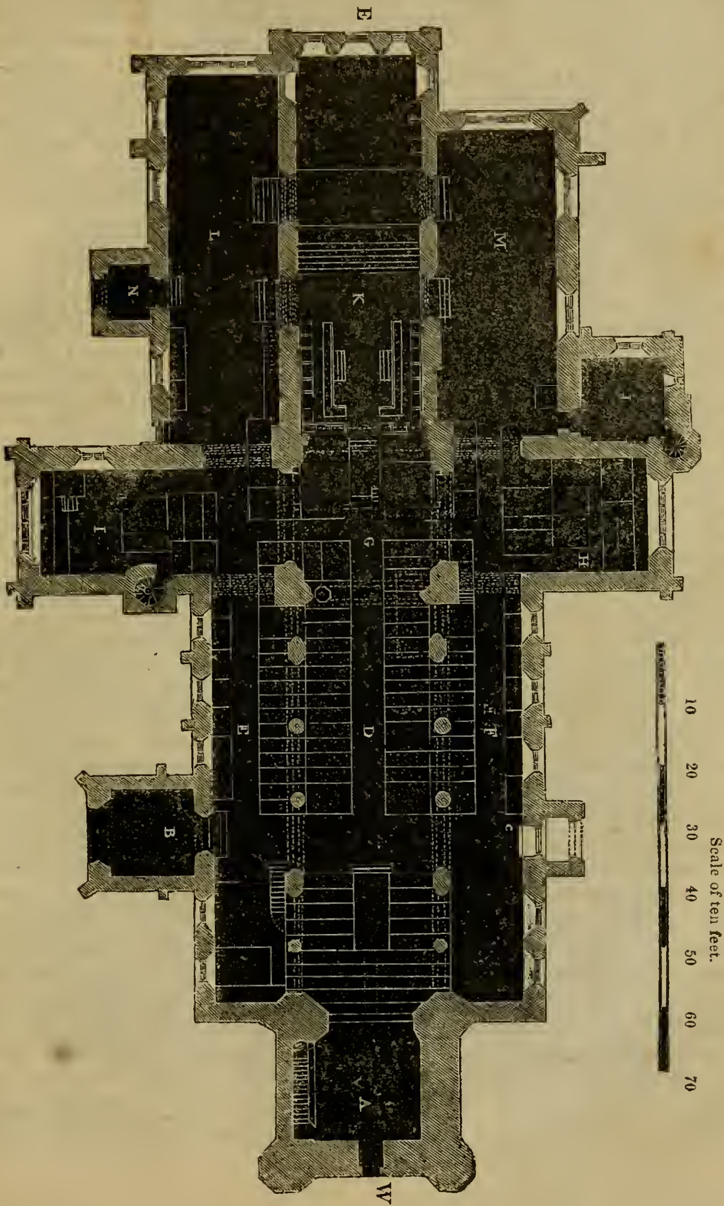
London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 69, NEW SERIES. | SATURDAY, JAN. 4, 1840. PRICE ONE PENNY. | No. 190, OLD SERIES.

GROUND PLAN OF WIMBORNE MINSTER.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

THE PENNY POSTAGE.

On the 10th of the present month (January), the long wished-for and fought-for uniform penny postage will be established throughout the United Kingdom. This great and enlightened measure has been opposed by a portion of the press; and we have witnessed with regret and surprise the course pursued by some of the most influential papers of the day, who, from motives which they have endeavoured to conceal, have set themselves in array against a project of incalculable public benefit, and opposed a vain resistance to the firm determination of nine-tenths of the nation; but to those who have energetically and triumphantly advocated the good cause, we beg in the name of that considerable and respectable portion of the public with whom we have the honour of holding communion, to tender our thanks for the signal service they have rendered to society. We also perceive with much satisfaction, that the voice of "The Mechanic" has found numerous echoes in contemporary publications; the "Morning Advertiser," having previously reproduced an article from this work, has the following in the publication of Friday se'nnight as a leading article:—

"We yesterday inserted a well-written article from "The Mechanic and Chemist," which, though humble in price, is a periodical of merit on the subject of the Penny Postage. In that article the writer clearly exposes the absurdities of the existing arrangements, and confidently maintains, that if the universal penny postage only once receive a fair trial, it will prove successful in every point of view, not even excepting its financial bearings. We have some doubt whether the same amount of revenue will ever be derived from a penny postage as the recent system yielded; if it does at all, it is clear it will not for some time. But any deficiency of revenue, whether the amount be great or small, which may be consequent on the adoption of the penny postage, is a consideration which ought not to weigh a feather when put in the balance against the individual and social benefits of which the measure will necessarily be productive. We feel assured, that the most sanguine mind has not as yet formed any adequate conception of the immense advantages which will result to the community from its adoption. It will foster and elicit the better feelings of human nature; it will call forth the latent sympathies which exist between man and man; it will draw closer and closer the tender ties of affection on the part of one relative to another; it will strengthen union among friends; it will bring heart into close and cordial contact with heart; it will increase to an inconceivable extent the facilities already existing for the mental and moral improvement of the poorer classes of society; and thus diffuse abroad, through the length and breadth of the land, blessings of unspeakable magnitude."

The system as at present prescribed by the Treasury, is still defective in some respects; but the grand object is attained, and letters will be conveyed from one corner of the kingdom to the other for one penny, provided they be pre-paid, and do not exceed half an ounce in weight.

WIMBORNE MINSTER.

(From a Correspondent.)

The following description of the collegiate church of St. Cuthberga, Wimborne Minster, Dorset, is extracted from a work just published by H. Herbert, Wimborne. It contains magnificent views of the exterior and interior of the Minster, drawn and engraved by N. Whittock.

"The exterior of this ancient structure has been greatly injured by injudicious repairs and alterations made at various periods of time. The eastern window is formed by three lancet-headed lights, with ornamented divisions; but the exterior does not present that peculiar construction which will be found in the interior. The arches below the window were intended to give light to the crypt. The window of the side aisle is light and elegant, but in a much later style of architecture than the window of the choir. The northern entrance to the church is from a modern porch. The windows of the choir and side aisle are of various forms. The roof is leaded. The window of the north transept is large but ill-shapen; and, from the taste and judgment displayed in the recent repair and restoration of the interior of the church, we may anticipate that it will, at no distant period, be removed. The central tower is the most ancient and beautiful part of the exterior of the Minster; it springs from the intersection of the nave and transepts. The roof of the north transept has been considerably lowered. Traces of the height of the original roof may be seen on the northern wall. Above the gables rises the first story of the tower: it contains two circular-headed Norman windows, between which is a blank-pointed arch; the whole are connected by

a dripstone, and ornamented by slender shafts with carved capitals. The second story contains seven semicircular arches, which intersect each other, forming pointed arches at their intersections: a bold ornamented tablet enriches the arches, which are also ornamented with shafts having sculptured capitals. The arch in the centre is pierced to admit light to the interior of the tower; the cornice above is supported by blocks of stone resembling beam-ends; it encloses sculptured heads at each angle. The battlements and pinnacles were added to the tower after the fall of the spire, and do not at all contribute to the architectural beauty of the building. The angles of the tower below the parapet are broken by slender shafts divided by bands. The roof of the nave is leaded. The five clerestory windows of the nave appear square-headed in the exterior of the building; they are in the perpendicular style of architecture, but are nearly hid in this view by the projection of the transept. The porch leading to the nave is entered from a pointed arch. The gable is lofty, and contains a window, which affords light to the record room.

The western tower was erected about 1460, and has the symmetry and chaste ornament which characterized the building at the close of the fifteenth century. The

lower is one hundred feet high, and is divided into four stories. The pinnacles, which are rather too low for the tower, are ornamented with crockets and finials. The western wall of the tower originally contained an elegant doorway and window, both of which requiring repair, were entirely removed in 1739, and the present oval window and heavy doorway supplied their places. The dripstone of the original window still remains, the space between that and the moulding round the oval being plastered up. The belfry of this tower contains six bells; the great bell, originally dedicated to St. Cuthberga, and called after her name, was re-cast in 1689; it weighs $36\frac{1}{2}$ cwt.

The porches and windows of the south side of the Minster are in much better preservation than on the north. The centre tower is seen to great advantage in this view. The circular turret at the angle formed by the walls of the nave and transept, encloses a staircase which leads to the library. The large window in the south transept has been beautifully restored, and is an elegant specimen of modern Gothic architecture."

This church contains many curious relics of antiquity, and other interesting objects:—

"Beneath an arch on the north side of the choir, is a plain altar tomb of grey marble, bearing the remains of a brass inscription along the verge:—' - - - Conjux quondam Henrici Courtenay Marchionis Exon et mater Edwardi Courtenay nuper Ao. - - - -' This tomb was erected for Gertrude, the second wife of Henry Courtenay, Marquis of Exeter, and mother of Edward Courtenay, Earl of Devonshire, who died in 1556. The space above this tomb will shortly be decorated with stained glass, executed by Willomet, by the command of the Earl of Devon. (See engraving, page 145.)

Beneath a newly-constructed gallery is a curious old orrery, connected with the works of the clock, showing the age and phases of the moon, the revolution of the planets, and the situation of the sun, according to the Copernican system of astronomy."

The engraving (front page) is the ground plan. The length of the church from east to west, measured externally, is 200 feet.

"A, the western tower, showing the stairs to the gallery.
B, the northern porch.
C, the southern porch.
D, the nave; length 70 feet, breadth 27.
E, F, side aisles to the nave; 70 feet long, 13 feet wide; making the width of the church in the interior, 53 feet, exterior 60 feet.
G, the central tower; each side of the square measuring 31 feet, including the piers.
H, south transept; 33 feet long, 19 feet wide.
I, north transept; 40 feet long, 19 feet wide.
J, the vestry; 16 feet by 14 feet.
K, the choir; length 65 feet, breadth 21 feet. The length from the centre tower to the top of the steps leading to the altar, is 33 feet; from the steps to the eastern wall, 32 feet.
L, north side aisle to choir; 62 feet long, 21 feet wide.
M, south side aisle to choir; 54 feet long, 20 feet wide.
N, north-east porch."

THE CHEMIST.

THE ELEMENTS AND THEIR COMBINATIONS.

To the Editor of the Mechanic and Chemist.

Sir,—Having described oxygen, I will proceed to chlorine. Chlorine was discovered by Scheele in 1774. He called it *dephlogisticated acid.* The term *oxymuriatic acid* was afterwards applied to it by the French chemists. The more appropriate term *chlorine* (from *χλωρος*) which merely designates its colour, was given to it by Sir H. Davy. To obtain this gas, a mixture of equal weights of black oxide of manganese and hydrochloric acid are heated over a lamp in a glass retort. Chlorine is copiously evolved, and may be collected over warm water. It is absorbed by cold water, and therefore cannot be long retained over that fluid; so that it should be received into bottles provided with ground stoppers previously greased a little. It may be procured from a mixture of eight parts of common salt, three of pulverized black oxide of manganese, four of water, and five of sulphuric acid. Chlorine at common temperatures and pressures, is a permanently elastic and gaseous fluid; but by subjecting it to a pressure of about four atmospheres, and at the temperature of 60°, Professor Faraday condensed it into the liquid form. It has a pungent and disagreeable smell, and is highly injurious when respired. Its colour is greenish yellow. The specific gravity of chlorine, compared with hydro-

gen, is as 36 to 1; with atmospheric air, its specific gravity is as 2.500 to 1.000. The specific gravity of liquid chlorine is about 1.330. At a temperature of 60°, water dissolves two volumes of chlorine. The solution is of a pale yellow colour, has an astringent nauseous taste, and destroys vegetable colours. It is a powerful antiseptic and destroyer of contagious and infectious matter. Many bodies, such as phosphorus and several of the metals, are spontaneously ignited by chlorine, and burn in it with much brilliancy. In these cases binary compounds result, which are termed chlorides. Brass or copper leaf, and powdered antimony, serve well to show the action of chlorine on certain metals. When introduced into the gas, they enter into immediate combustion, and chlorides of copper and antimony are formed.

Chlorine and Oxygen.—Chlorine and oxygen unite in four proportions, forming two oxides and two acids.

The protoxide of chlorine consists of	36 parts chlorine	+	8 oxygen.
Peroxide	36 —	+	32
Chloric acid	36 —	+	40
Perchloric acid	36 —	+	56

Protoxide of chlorine was discovered by Sir H. Davy, and in consequence of its deep yellow-green colour, he gave it the name of *euchlorine.* It is easily absorbed by water, and must therefore be collected over mercury; but that metal gradually decomposes it, so that it cannot long be retained in contact. To obtain protoxide of chlorine, introduce into a retort two parts of chlorate of potassa, and pour upon it one part of concentrated hydrochloric acid, previously diluted with one part of water; apply a very gentle heat, so as to occasion a moderate effervescence. This gas is very pernicious to respiration. Its specific gravity compared with air is as 2.44 to 1.000. Water dissolves ten volumes of this gas, and acquires its peculiar odour and colour. It destroys vegetable colours, previously reddening some of the blues. Its most remarkable character is the facility with which it is decomposed; when gently heated in the upper part of a small tube, standing over mercury, a kind of explosion, attended with a flash of light, ensues, and the tube is projected to some distance. This gas sometimes explodes while it is collecting, or in being transferred from one vessel to another, or even by the heat of the hand; so that it should be cautiously dealt with, and examined and collected in small quantities only.

Peroxide of chlorine is obtained as follows:—About 50 grains of chlorate of potassa are moistened with a few drops of sulphuric acid, and rubbed together with a platinum spatula, till they incorporate and form a solid mass of an orange colour. This mass is to be introduced into a small glass retort, and gradually warmed in a water-bath, the temperature of which must be carefully kept below 212°, which may be managed by mixing alcohol with the water. A bright yellowish-green elastic fluid passes off, which is rapidly absorbed by water, but may be collected in small tubes over mercury. The colour of this gas is more brilliant than that of the protoxide, and its odour more aromatic. Its specific gravity, compared with air, is as 2.360 to 1.000. It requires the same and even greater precautions in preparing and transferring, than the former gas. Its saturated aqueous solution is of a deep yellow colour; an astringent and corroding taste. It destroys vegetable colour.

Chloric acid I have described in my papers on the acids.

Perchloric acid is procured by distilling perchlorate of potassa with its own weight of sulphuric acid, diluted with a fourth part of water, at a temperature of about 280°; white vapours pass off, which condense in the form of a colourless liquid. It does not exist independent of water or a base.

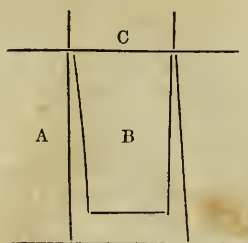
J. Mitchell.

POROUS JARS FOR GALVANIC BATTERIES.

To the Editor of the Mechanic and Chemist.

Sir,—A short time since, being in want of a few porous jars for a small set of galvanic batteries I was then constructing, I applied to a philosophical instrument maker for the purpose of procuring them, when I found the prices asked were sixpence and eightpence each, and which I thought rather extravagant, so I determined not to submit to it, and set myself thinking how I could avoid it; at last I hit upon a plan which answers perfectly, and so exceedingly cheap, that I can make the size I want for sixpence a dozen. The manner in which I make them is this:—I first form a mould by coiling up a piece of sheet tin (such as saucepans are made of)

the size I want. The size I have made is three and a half inches high, and two and a quarter inches diameter. For the above, I make the coil a little higher than I wish the jar to be. I then coil up another piece, so as to fit into the former, leaving little less than the fourth of an inch between the two; the inside coil must taper slightly towards the bottom, so as to facilitate the extraction of it after the jar is made. To form the bottom of the jar, I pass a wire transversely through the centre piece of the mould at a certain height from the bottom of it, so as to leave a space of whatever thickness I wish at the bottom of the jar. I also put a piece of tin or wood at the bottom of the centre piece, so that the composition of which I form the jars, may not fill the centre also. I then weigh out a quarter of a pound of plaster of Paris, and mix it up with three ounces of water. I have also coloured the jars the same as those sold at the shops, by mixing with the plaster some Armenian bole; but before pouring the plaster into the mould, I oil it; I then place the outer piece on a flat surface, so that when the liquid plaster is poured into it, it may not escape. I then introduce the centre piece evenly, so as to form the sides of the jar of equal thickness. In about ten minutes the plaster will be sufficiently hard to allow the centre piece to be taken out. I then open the outside of the mould and allow the jar to slip out. It may then be finished by cutting off the superabundant plaster round the edges. But as all porous jars when wet have a tendency to fall to pieces, I cut a slip of thin sheet copper, about half an inch wide, and coil it round the top of the jar, lapping the ends over, and making them fast with a pair of pliers, thereby forming a surface to lay hold of, without incurring the risk of breaking the jar. In order to render the operation more clear, I here give a sectional drawing of the mould :— A is the outer coil; B, the centre piece;



C, the wire to prevent its sinking too low, to form a bottom. Hoping this will be of service to your readers, I remain, &c.,

J. Mitchell.

SHEFFIELD MECHANICAL AND CHEMICAL SOCIETY.

To the Editor of the Mechanic and Chemist.

Sir,—In one of the numbers of your useful Magazine, "Tyro Chemicus" proposed a society for the study of practical mechanics and chemistry; and you kindly offered to notice the proceedings of such societies. I have no doubt, you as well as Tyro Chemicus, will be very glad to hear of one being established. I had often thought that such a society would be beneficial; but there was a great difficulty in getting a sufficient number of young men to persevere. It was with much pleasure that I read the proposal, and I immediately named it to a few friends, who were fortunately of the same opinion. The first meeting, consisting of five, was held on the 22nd of November; when the following rules were adopted: (perhaps they may be of use to others in the same situation)—

1. The object of this society is the advancement of its members in the arts and sciences.

2. That every member in turn shall read a paper; or, on neglect of so doing shall incur a fine of 6d.

3. That political and religious subjects be not introduced, either in papers or discussions.

4. That the meetings of this society be held every Wednesday evening, at eight o'clock; when a memorandum shall be made by the secretary of the proceedings.

5. That each member deposit —— per month into the hands of the secretary at the close of the meeting, and that the forfeit for non-payment or non-attendance, unless in cases of necessity, be —— per week; and also, that all members neglecting to pay for the space of six weeks, shall be excluded or fined.

6. That a secretary be elected every six months, who shall also hold the office of treasurer.

7. That the funds of this society shall be expended in apparatus or books, as the majority may deem fit.

8. That any member may propose a friend wishing to become a member, whose name shall remain in the proposition lists for three successive meetings, when he shall be admitted by a majority.

9. That any member breaking the above rules, shall be excluded or fined, as the society shall deem fit.

On account of the approaching holidays, the meetings are postponed till Christmas, when it is proposed to have a social tea-party, to be continued yearly. I think that communications of newly-invented machines, discoveries, or new and important papers from one society to another, would be very advantageous to both: and, as the postage is about to be so very low, it will be very practicable. Any information from Tyro Chemicus as to what manner the society in London is conducted, will be very thankfully received. Papers have already been read on attraction and electricity. We amount to 9 at present.

I remain yours, &c.,
W. E.

N.B. Any letter addressed to William Ellis, Infirmary Road, Sheffield, and left at No. 54, Wych Street, Strand, will find the secretary.

[We feel peculiar pleasure in recommending this letter to the consideration of our readers, and, as far as the limits of this work will permit, we shall be happy at all times, to forward the views of all such highly praiseworthy institutions. But another description of assistance, of more direct and immediate advantage, is required to render a society of this kind, effective and permanent. That assistance it is out of our power, or, at least, out of our province to supply; but a suggestion from a publication of unquestioned integrity, and sober honesty of purpose—a publication whose very existence is dependent upon that good order and tranquil contentment in society which it endeavours and tends to promote—such recommendation, if it does not produce conviction of the goodness of the cause for which we plead, and consent to the proposals which we submit, will at least be a convenient and advantageous mode of making known the existence, intentions, and wants of the society. It is a goodly sight to see a company of young men renounce the foul-mouthed demagogue, and the alluring libertine, to cultivate useful arts, and found the edifice of their future lives, on the solid rock of knowledge and respectability; and it is not only the duty, but the interest of every good citizen who has "a stake in the country" to encourage and assist them.

Discretion forbids us to mention names; but we know that there are many opulent, enlightened, and liberal men in Sheffield, and we will venture a prediction that they will not refuse the assistance of a little pecuniary gift towards the purchase of books and instruments, the first necessity of mechanical and chemical associations.—It is proper to state that it is not at the request, or with the knowledge of the society that we are induced to make this appeal; but solely from a conviction that it will accelerate the accomplishment of their object, and probably promote the formation of other societies of a similar nature.—Ed.]

QUERIES.

The best way for making the different sorts of paste for fishing? Also a description of the general fishing instruments; as also how to make artificial flies? W. Conquest.

The best means of converting soft water into hard; or the most permanent manner of impregnating it with limestone, sulphate of lime, or any other and better material that will produce a wholesome hard water in large quantities? W. L. Lizard.

How, in the preparation of oxygen gas from saltpetre, the nitrogen which is produced is to be separated? 2. Could the nitrogen by any means be separated from the air, as to leave the oxygen? 3. How to procure cyanogen gas from a less expensive material than cyanuret of mercury? 4. What colourless varnish can be applied to paper, so as to leave it perfectly flexible? F.

ANSWER TO QUERIES.

Parasol rings are not made from a composition, but are turned out of horses' leg bones.

To make Yellow Fire.—Use nitrate of soda, mixed with sulphate of potass and sulphur. The proportions I do not know, but they are very easily determined by experiment. F.

To separate Metal from the Dross.—"J. S. B." The dross which accumulates on the surface of lead when in a state of fusion is an oxide, produced by the action of the oxygen of the air; which has the property of combining with that metal at high temperatures. It may be easily reduced to the metallic state, by mixing it with half its weight of powdered charcoal, and exposing it in a crucible to a red heat until the reduction is complete. A wind-furnace would be the best for this operation; but a common fire, with the assistance of a pair of bellows, is quite sufficient for the purpose, except where a large quantity of the dross is required to be reduced. The reduction will be more complete if the crucible has a cover to it, with a small opening for the carbonic acid gas (which is formed during the operation) to escape; by this means the oxygen of the air will be prevented from acting on the reduced metal. A. Taylor.

Expansion of Water.—"D. J." The expansion of water, both by heat and cold, is, we think, an apparent rather than a real anomaly, though we have never met with any attempt at an explanation. Its maximum of density, as determined by the careful experiments of Dalton, is 42.5 Fahr.

Heated above, or cooled below this point, its bulk increases; and, by a singular arrangement, the dilatation is the same for the same number of degrees, upwards or downwards. All bodies which, by cooling, assume the form of crystals, expand in passing into the solid state; from which it should seem that *they* also have a maximum of density; but that the range between the point indicating this maximum of density, and that marking their temperature at the moment of solidification is so small, as hitherto to have remained unmeasured. Crystallization is the arrangement of the particles of a body in a determinate form, under the pressure of the atmosphere. This arrangement, it is evident, can be effected only by some previous motion, or turning about of the disintegrated particles in a fitting direction, which motion may be either sudden or progressive. If sudden, then the points marking the temperature of a liquid on reaching its greatest density, and that at the instant of solidification, must nearly coincide, and the difference may, therefore, be incommensurable; but if it be progressive, as we take it to be in the case of water, then the motion preparatory to crystallization commences when the temperature falls to 42.5, and goes on gradually increasing down to 32; by which time the particles have arranged themselves into the position proper for congelation, when the simultaneous pressure of the atmosphere wedges them into a mass, and the crystal, or ice, is the visible product. If this theory be correct, then, as a corollary, 42.5 is the lowest point at which water remains perfectly fluid. W. W.

Query.—" What will be the thickness of metal required for a concave copper ball eight inches diameter without, so as to sink to its centre in common water?" I am afraid that the solution given to the above query by " W. W." in page 77, will be too difficult for many of your readers, and I therefore forward you the following:—A cubic foot of common water weighs 1000 ounces, and a cubic foot of copper weighs 8878 ounces. The solid contents of a sphere, or ball, is equal to its diameter multiplied by .5236. Hence, $\frac{8^3 \times .5236}{2} = 1340416$, the contents in inches of half the sphere = the quantity of water displaced. And, as 1728 (inches in a cubic foot) : 1000 ounces : : 134.0416 inches : 77.57 ounces, the weight of the displaced water. Also, as 1728 inches : 8878 ounces : : 268.0832 (the contents in inches of the whole sphere) : 1377.34 ounces, the weight of a solid copper sphere of eight inches in diameter, from which being subtracted the before mentioned 77.57 ounces, there remain 1299.77 ounces, the weight of a sphere of copper equal to the vacuity of the ball. Then, as the solid contents of spheres are in proportion to the cubes of their diameters, we say,—As 1377.34 : 8^3 (=512) : : 1299.77 : 483.164, the cube root of which (= 7.847) subtracted from 8 inches, there remains .153 for the difference between the diameter of the vacuity and that of the sphere, one half of which (=.0765, or nearly one-thirteenth of an inch, and corresponding nearly with the quantity found by " W. W.") is the thickness of the metal of the concave copper ball required. W. N.

The Wine Question.—Putting x the original quantity, it may readily be shown, that the portion left after the 5th operation will be $\frac{\overline{x-12}|^5}{x^4}$ which, by the question, is to be = 54. A few trials will show that the value of x in this equation between 101 and 102.

$$\text{Now } \frac{89^5}{104^4} = 53.661 \text{ and } \frac{90^5}{102^4} = 54.552$$

Then .891 : 1 : : .339 : .38.

Hence we have 101.38 for the original quantity.

Assume again 101.38 and 101.39;

$$\text{Now } \frac{89.38^5}{101.38^4} = 53.99 \text{ and } \frac{89.39}{101.39^4} = 54.008.$$

Then .018 : .01 : : .01 : .0055.

Hence we have 101.3855 for the original quantity.

More assumptions would carry it nearer the truth, but this is sufficiently accurate. " T. S. R." has failed in answering it, from making use of *single* position, which, of course, does not apply in cases of involution. In answering the question, as we did, the week after it was proposed, only that the letter failed in reaching its destination (see page 126), we supposed the proposer, " B. C." to mean only four operations; if such were his intention, then

$$\frac{\overline{x-12}|^4}{x^3} = 54 \text{ where } x \text{ lies between 93 and 94;}$$

$$\text{Then } \frac{81^4}{93^3} = 53.51 \text{ and } \frac{82^4}{94^3} = 54.43.$$

Now .91 : 1 : : .49 : .53.

Hence we have 93.53 for the original quantity. That this is sufficiently near is easily shown, for

$$\frac{81.53^4}{93\,53^3} = 54.0028.$$

More assumptions would, of course, carry it nearer. W. W.

TO CORRESPONDENTS.

Engine.—*We should recommend, as the best shape, a cylinder with convex ends; the lamp should be placed in the centre, extending longitudinally, as nearly as possible, to the ends. There must, of course, be tubes to introduce the water, and to allow the escape of the steam. In locomotive engines, boilers have been adopted, composed of iron tubes, connected together by smaller tubes, or flat chambers, in the shape of the cover of a book, with the leaves taken out.*

Sherwood.—*If he will repeat his former queries in his next communication, they shall be attended to.*

Electron *will receive a letter by post; and,* if nothing occurs in the interim to alter our determination, *his last communication will be commented on in our next.*

Tyro Chemicus *will find a letter addressed to him at our office.*

London: Printed at " The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell-street. Strand: and may be had of all Booksellers and Newsmen in Town and Country.

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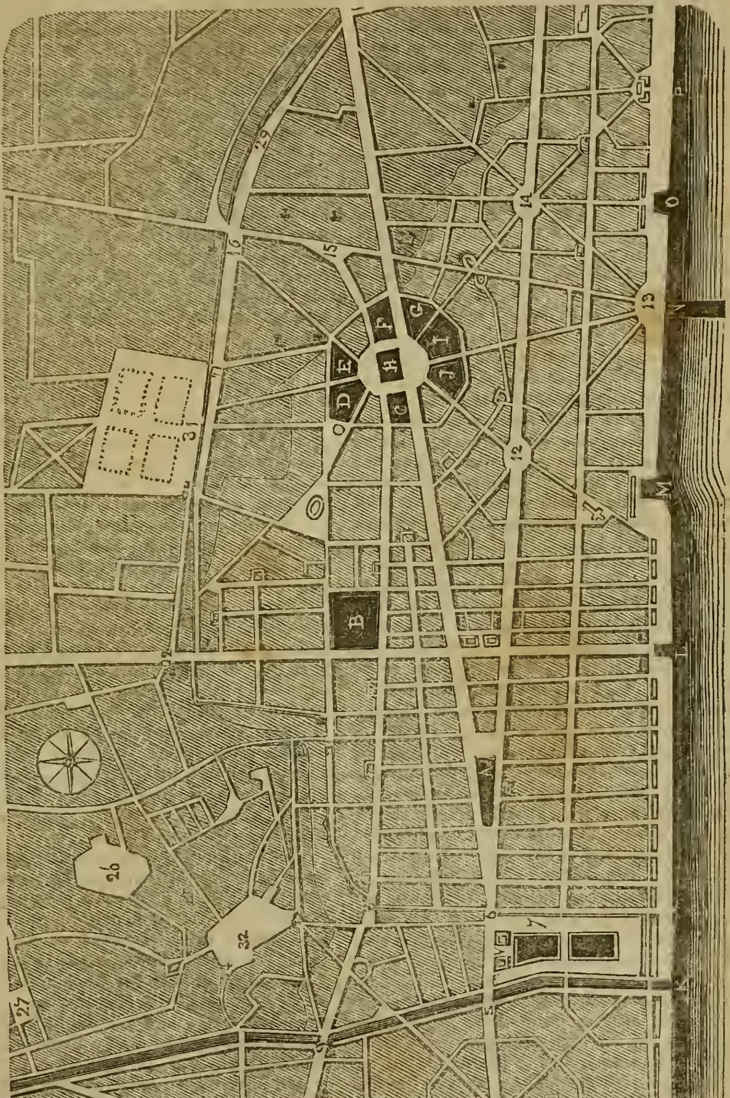


SIR CHRISTOPHER WREN'S PLAN FOR REBUILDING LONDON.

 City Press, 1, Long Lane, Aldersgate Street; D. A. Doudney,

SIR CHRISTOPHER WREN'S PLAN FOR REBUILDING LONDON.

LONDON, the vast metropolis of the British empire, has long since attained that height of glory and magnificence which places it immeasurably above all other cities in the world. Its superiority is not derived alone from its extent, or the amount of its population; it is equally pre-eminent for the beauty of its edifices, the convenience of its spacious streets, and the comfort of its houses; its markets are supplied with abundance of the best provisions in the world. It is the commercial emporium of the world, and the strongest bulwark of English liberty. It is ruled by magistrates, who, as a body, are more liberal, enlightened, and upright, than those of any foreign city. Its supply of gas, water, coals, and police, may fearlessly challenge the world; and its still-increasing grandeur suggests to the mind the prediction of a future destiny, surpassing even the fabulous creations of the poet!

The extent and importance of this city have been gradually increasing during more than a thousand years; but the modern erections and improvements commenced after the great fire in 1666, which reduced the city to a heap of ashes.

That awful calamity destroyed the buildings which covered 436 acres of ground, containing 600 streets, 13,200 dwelling houses, 89 churches, the city gates, Guildhall, many public structures, hospitals, schools, &c. After the fire, when the scene of devastation could be surveyed without danger, the eye of genius saw, by anticipation, a glorious city arise from the smoking ruins. A man appeared at the time destined by Providence as the instrument for converting the calamity into a blessing, and rebuilding the city in a style which should insure the future comfort and health of its inhabitants, and at the same time make it the most magnificent city in the world. This man was Sir Christopher Wren, and it is greatly to be regretted that his noble plan for rebuilding the city was not carried into execution. A glance at the ground plan (see front page) will show that many of the recent alterations about London Bridge, and those in contemplation at the Exchange, Farringdon Street, and many other places, are in accordance with the plan of Sir Christopher Wren, which he laid before King Charles the Second. It met the approval of that monarch, but the petty cavils and obstinacy of the citizens prevented its being carried into execution.

We extract the following description of Sir Christopher Wren's plan from Allen's "History and Antiquities of London."

"From that part of Fleet Street which escaped the fire, a straight street of 90 feet wide was to extend, and, passing by the south side of Ludgate, was to end gracefully in a piazza on Tower Hill.

In the middle of Fleet Street was to be a circular area surrounded with a piazza, the centre of eight ways, where, at one station, were to meet the following streets:—The first, straight forward, quite through the city; the second, obliquely, towards the right hand, to the beginning of the quay that was to run from Bridewell Dock to the Tower; the third, obliquely on the left, to Smithfield; the fourth, straight forward on the right, to the Thames; the fifth, straight on the left, to Hatton Garden and Clerkenwell; the sixth, straight backwards to Temple Bar; the seventh, obliquely on the right, to the walks of the Temple; the eighth, obliquely on the left, to Cursitor's Alley.

On passing down Fleet Street, and Ludgate Hill, Ludgate prison was to stand on the left side of the street, where a triumphal arch was to be formed, instead of the gate, in honour of King Charles II., the founder of the new city; and the Cathedral of St. Paul was to be situated where it now stands, surrounded by a triangular piazza.

Leaving St. Paul's on the left, a straight street was to extend directly to the Tower, adorned all the way, at proper distances, with parish churches; and leaving that edifice to the right, the other great branches were to lead to the Royal Exchange, which was to be seated in the middle of a piazza, between two great streets, the one from Ludgate, leading to the south front, and another from Holborn, through Newgate, and thence straight to the north front.

This excellent scheme was demonstrated to be practicable, without the least infringement on any person's property; for by leaving out the church-yards, &c., which were to be removed at a distance from the town, there would have been sufficient room both for the augmentation of the streets, the disposition of the churches, halls, and all public buildings, and to have given every proprietor full satisfaction; for though few of them would have been seated exactly upon the very same ground they possessed before the fire, yet none would have been thrown at any considerable distance from it; but the obstinacy of great part of the citizens, in refusing to recede from the right of rebuilding their houses on the old foun-

dations, was an insurmountable obstacle to the execution of this noble scheme, which would certainly have rendered the city of London one of the most magnificent in the universe."

Reference to the Plan (B).

The lightest part of the plan shows the extent of the fire; the black places show the intended site of the principal public buildings:—

1. Temple Bar.	12, 13, 14. Piazzas
2, 3, 4. Law Courts.	15, 16. Bishopsgate.
5. Fleet Bridge.	17. Mooregate.
6. Ludgate.	18. Cripplegate.
7. Markets.	26. Charter House.
8. Newgate.	27. Clerkenwell.
9. Holborn Bridge.	31. Moorfields.
10. Hatton Street.	32. Smithfield.

A. St. Paul's Cathedral.	I. Mint.
B. Guildhall.	J. Insurance Office.
C. Goldsmiths' Hall.	K. Entrance to Fleet River.
D. Post Office.	L. Queen Hythe.
E. Excise Office.	M. Dowgate.
F. Merchant Tailors' Hall.	N. London Bridge.
G. Bank.	O. Billingsgate.
H. Royal Exchange.	P. Custom House.

ON LIFE ASSURANCE.

We approach this subject deeply impressed with its vast importance, and the high responsibility incurred by every public writer who possesses the power of exercising any degree of influence upon public opinion; and we are fully sensible of the number and magnitude of the difficulties to be overcome, and the problems to be solved, before it is possible to arrive at that enlightened circumspection and accurate knowledge of facts, necessary in the investigation of so complicated a question:—a question which not only involves the happiness or misery of thousands of families, but, in its ultimate consequences, seems destined materially to affect the future condition of every class of society. We therefore admonish the reader to proceed with the utmost caution in his enquiries, and read with prudent and salutary suspicion, not only the alluring advertisements of interested companies, but even the most disinterested and learned works which treat upon this profound and vital question.

As a theory, the philanthropist, the moral philosopher, and the political economist, and indeed every friend to the well-being of society, must acknowledge the excellence of Life Assurance Institutions. All those who possess only a life interest in their incomes, may, by a small annual sacrifice, secure an inheritance, and the best of all possible protection for those who are dear to them, when their own fragile existence shall have vanished from the world. This class includes kings*, clerks, clergymen, officers, doctors, lawyers, and every description of artificers and tradesmen; — even the egotist (that unhappy being, who seeks only his own enjoyment, and therefore finds none) may purchase, and in some measure deserve the gratitude and affection of those with whom he is compelled or inclined to dwell, by affecting a small pittance of his income to the insurance of his life in their favour.

(To be continued.)

SUPPOSED EARTHQUAKE NEAR LYME.

On Christmas Eve, about six o'clock, the residents in the houses and cottages along the coast, between Lyme and Seaton, were alarmed by a convulsion of the earth, attended by fearful sounds: this was succeeded by reiterations of the phenomena, and it was soon ascertained that a course of mischief was in serious operation. On arriving at a part of the coast called Dowlands, a quarter of a mile from the sea, it was found that a large portion of land, on which there were several cottages, orchards, and a coppice, had been separated from their sites, leaving huge chasms in a lateral direction along the coast between Sidmouth and Seaton, to the extent of upwards of four miles. The convulsions of the earth continued, at various intervals, from the night of Tuesday, the 24th December, to Friday evening, the 27th, having, within that interval, occasioned the prostration and subsidence of buildings of various descriptions, and the displacement of large tracts of soil, besides a loss of property to a considerable extent; among the sufferers by which is Mrs. Inman, of Bishop's Hull, whose loss is estimated at upwards of 2,000*l*. Mr. Hallett, of Axmouth, and Mrs. Dare, also suffered heavily by the event. A huge rock, fifty feet high, appears in the sea off Culverhole, nearly a quarter of a mile from the spot where the principal scene of mischief presents itself. The soundings were taken around the newly-formed rock on Saturday. No lives were lost by the event, although several of the occupants of cot-

* William IV. insured his life in favour of certain branches of his family.

tages, who had left home to spend their Christmas Eve, found, to their great astonishment on their return, no other vestiges of their dwellings but those presented by the roofs and chimneys discernible above the chasms in which their habitations were engulphed. The new road from Charmouth to Lyme is utterly destroyed. The visitation, beside the destruction of property, has occasioned great alarm and anxiety among the owners of buildings and estates in the vicinity. Multitudes of persons, from all parts, have been for several days past rushing into Lyme, Seaton, and Charmouth, eager to ascertain the nature and extent of the catastrophe. The total loss of property is estimated at 6,000*l.* The cliffs on the coast do not appear to have suffered any disruption, all the mischief being inland.—*Taunton Courier.*

ON THE CIRCULATION OF THE BLOOD.

[THE following interesting and instructive Lectures were delivered before the pupils at Miss Turk's school, Walworth, Nov. 1838, by Mr. J. S. Dalton. They have not been published before, and we feel obliged to the author for selecting this work as the medium of their first appearance.]

Having been requested to deliver before you a short course of lectures on the "Principles of Physiology," I propose, if you please, this evening to commence, by bringing under consideration the principal phenomena connected with the circulation of the blood. Physiology is a subject which so seldom engages the attention of ladies, more particularly as a branch of necessary education, that I feel it will be advisable for me to preface the lecture with a few observations, showing how foolish and injurious the prejudice has been, which would prevent you becoming acquainted with those natural laws, on which depend the preservation of health, and the enjoyment of that happiness, which cannot be secured without it. I trust I shall be able to do this in a manner which will prove to you, that there is nothing either unpleasing or offensive in this kind of knowledge when properly brought before you, but that, on the contrary, it abounds with instances of the most beautiful applications of science, and of mechanical contrivances, which cannot be contemplated without advantage and pleasure. I am aware that many persons consider it is quite unnecessary that ladies should acquire this kind of information, and it is so indelicate that it should be entirely excluded from their education; but the importance of it, more particularly to ladies, I will prove to you by a short extract from the work of a celebrated physician, "The Principles of Physiology, applied to the Preservation of Health, by Dr. Andrew Combe;" and I will leave you to judge for yourselves, after the conclusion of the lecture, whether there is anything in the slightest degree indelicate, or, indeed, calculated to offend the most fastidious delicacy, in the language or the diagrams which I shall use to explain the "Circulation of the Blood," the principal subject for our consideration this evening.

With regard to the importance of physiological knowledge, or a knowledge of the laws on which our health depends, Dr. Combe observes, "It has been objected, that to teach any one how to take care of his own health, is sure to do harm, by making him constantly think of this and the other precaution, to the utter sacrifice of every noble and generous feeling, and to the certain production of hypochondriacal peevishness and discontent. The result, however, is exactly the reverse; and it would be a singular anomaly in the constitution of the moral world were it otherwise. He who is instructed in, and familiar with, grammar and orthography, writes and spells so easily and accurately, as scarcely to be conscious of attending to the rules by which he is guided; while he, on the contrary, who is not instructed in either, and knows not how to arrange his sentences, toils at the task, and sighs at every line. The same principle holds in regard to health. He who is acquainted with the general constitution of the human body, and with the laws which regulate its action, sees at once his true position when exposed to the causes of disease, decides what ought to be done, and thereafter feels himself at liberty to devote his undivided attention to the calls of higher duties. But it is far otherwise with the person who is destitute of this information, uncertain of the nature and extent of the danger, he knows not to which hand to turn, and either lives in the fear of mortal disease, or, in his ignorance, resorts to irrational and hurtful precautions, to the certain neglect of those which he ought to use. It is ignorance, therefore, and not knowledge, which renders an individual full of fancies and apprehensions, and robs him of his usefulness. It would be a stigma on the Creator's wisdom, if true knowledge weakened the understanding, and led to inju-

rious results. And accordingly, the genuine hypochondriac, whose blind credulity leads him to the implicit adoption of every monstrous specific, is not the person who has gained wholesome knowledge by patient study in the field of nature; but he, and he alone, who has derived his notions of the human constitution, and of the laws of nature, from the dark recesses of his own crude imagination. Those who have had the most extensive opportunities of forming an opinion on this subject from experience, bear unequivocal testimony to the advantages which knowledge confers in saving health and life, time and anxiety. Thus Dr. Beddoes, in alluding to the delicate constitutions of females of the higher ranks in this country, remarks, *that he cannot* "*conceive how they can be rendered more hardy, or less nervous, if that term is preferred, otherwise than by being seasonably taught the principles of self-management*," and adds, that he specifies the *principles*, "because little good can be expected, unless we proceed, as in other instances, where we exhibited to sense that connexion between cause and effect, which constitutes the order of nature.

It is my intention on the present occasion, and in the future lectures I shall have the pleasure of delivering here, to act on the excellent advice of Dr. Beddoes, and, by explaining "the principles of physiology, enable you to understand the more important operations of the animal economy, and, I trust, excite such a desire of knowing more of the subject, as will induce you to refer to some of the many excellent treatises that have been published on this subject, principally for the instruction of ladies, and which I shall subsequently allude to more particularly.

"The circulation of the blood," is the term used to explain that wonderful action which is constantly going on within us, by which the blood is propelled from the heart over the whole body, and returned again to the point from which it started, after performing the many important offices required of it in its passage. Before describing how the blood circulates, it will be well, perhaps, for me to describe briefly a few of the important offices it performs during its circulation, both because they will best illustrate the importance of a knowledge of the subject, and also because they will inform you how surpassingly wonderful are many of the processes constantly going on in our systems, of which most persons are completely ignorant.

The first use of the circulation is to supply the vital fluid to the different organs of the body, so that the latter may be adequately nourished,—that the loss of substance which is continually occurring may be renewed—and that the various structures may receive a sufficient supply of nourishment to enable them to increase in size as they may be required, and to remain in a state of health.

It is a well-ascertained fact, though it may not perhaps be popularly known, that our bodies are not the same any two moments together. We are continually changing, and our bodies of to-day probably do not contain a single particle of the substance of which they were composed some six or seven years ago. In fact, as far as our bodies are concerned, we are entirely different individuals; and as the change is continually taking place, we are not really the same persons to-day that we were yesterday, or even that we were when I commenced this lecture. When Hamlet exclaimed,

> "Oh that this too, too solid flesh would melt,
> Thaw, and resolve itself into a dew,"

he was not aware that the process was really taking place, though not quite so rapidly as he desired. Yet such was the fact, and the rapidity of the action, considering that we are quite insensible of it, is indeed surprising. The loss of the body in substance is principally by *perspiration;* not that kind of perspiration alone which has been so emphatically characterized in Holy Writ, as "the sweat of the brow" (or as a polite Frenchman termed it, "the perspiration of the eyebrows"); this is called *sensible perspiration.* But there is another kind, by which the body sustains a still greater loss of substance—namely, *insensible perspiration,* which is so called because we do not so palbably perceive it as we do the former. You will probably be surprised to learn, that of every eight pounds of substance lost by the body, five are lost by this means; and that in the course of twenty-four hours every person, on an average, loses from three to six pounds from this cause. The manner in which this was proved, I shall take the liberty of reading to you from a paper of mine, published in one of the periodicals some time since on this subject. Insensible perspiration, though not directly visible to the sight, may easily be rendered apparent by placing our hands upon a cool metal surface, or upon a looking-glass; we shall then perceive a slight moisture which has proceeded from them. This is the insensible perspiration; and when it is recollected that it is constantly being given

off from the whole surface of the body, day and night, summer and winter, it will not appear surprising that we lose so much from this cause. Another source of waste is the vapour from the lungs. This, though trifling in quantity each time the breath is expired, or driven out from the chest, amounts to a considerable quantity in the course of twenty-four hours. Messrs. Lavosier and Seguin made a series of very accurate experiments to determine the exact waste of the body from these two causes. They proceeded as follows :—They were first enclosed in a varnished silk bag, with no opening, except a small place to breathe through, and which orifice was glued round the mouth of the experimenter, so that the perspiration of the body was of course prevented from escaping into the atmosphere. Before entering into the bag, the experimenter was accurately weighed, and so was the bag also, in order that the weight of each might be known. After he had remained in the bag for an hour or two, he was taken out and again weighed. It was then found that his body had *lost* a certain quantity, and that the weight of the bag was *increased* by very nearly an equal quantity. It was not quite as much heavier as the body was lighter, because a certain quantity had been lost by the vapour of the lungs, which could not of course be confined, but was dissipated in the atmosphere. By this means, the experimenters were able to ascertain how much, in weight, their bodies lost by visible and invisible perspiration in any given period, and they state it to be what I before mentioned; namely, from three to six pounds in twenty-four hours. At different periods of the year, and even of the day, there is a slight difference, but this may be considered a fair average.

(To be continued.)

MOUNTAINS.

The mountains of America are much superior in height to those in the other divisions of the globe. Even the plain of Quito, which may be considered as the base of the Andes, is elevated farther above the sea than the top of the Pyrenees. This stupendous ridge of the Andes, no less remarkable for extent than elevation, rises, in different places, more than one-third above the Peak of Teneriffe, the highest land in the ancient hemisphere. The Andes may literally be said to hide their heads in the clouds; the storms often roll, and the thunder burst below their summits, which, though exposed to the rays of the sun in the centre of the Torrid Zone, are covered with everlasting snow. The height of the most elevated point in the Pyrenees is, according to M. Cassini, 6,646 feet. The height of the mountain in the Canton of Berne is 10,110 feet. The height of the Peak of Teneriffe, according to the measurement of P. Feuille, is 13,178 feet. The height of the Chimborazo, the most elevated point of the Andes, is 20,280 feet, no less than 7,102 feet above the highest mountain in the ancient continent. The line of congelation on Chimborazo, or that part of the mountain which is perpetually covered with snow, is no less than 2,400 feet from its summit.

W. C. D.

[Our correspondent will find that there are higher mountains in Asia than any he has mentioned. A paper on this subject will shortly appear in "The Mechanic." —Ed.]

MULTIPLICATION.

To the Editor of the Mechanic and Chemist.

Sir,—According to Cocker, and not only according to Cocker, but according to Wyngate, Fenning, Dilworth, Fisher, Vyse, Walkingame, and a host of others, it would appear that feet, inches, and parts, may be multiplied into feet, inches, and parts; or what do they mean by saying multiply 12 feet 8 inches and 9 parts, by 9 feet 6 inches and seven parts, and giving rules for doing the same. And if feet, inches, and parts, can be multiplied by or into feet, inches, and parts, what reason can be given why pounds, shillings, and pence, should not or cannot be multiplied into pounds, shillings, and pence, seeing that the questions are similar; for the inches and parts are but fractions of a foot, as also are shillings and pence fractions of a pound. What difference can it make whether we consider the quantities given to be multiplied be feet and parts of feet, pounds and parts of pounds, or whether we consider the quantities as number only, without reference to things, the operations in either case being the same. It appears to me, that the object of the querists was to be informed how pounds, shillings, and pence, could be multiplied into pounds, shillings, and pence, after the same manner that feet, inches, and parts, are duodecimally multiplied into feet, inches, and parts. If such be their object the following is the answer.

Place the given quantities one under the other, pounds under pounds, shillings under shillings, &c., and proceed thus :—

multiply the upper line by the number in the place of pounds in the bottom line, and set down the product as in multiplication of money, pounds under pounds, &c., as in example; multiply the 10s. 6d. in the lower line by the number in the place of pounds in the upper line, thus 9 × 10d. 6d., and place that product as before, pounds under pounds, &c. Multiply the 10 by the 19 in the place of shillings thus—10s. × 19s. = 190s. and say 190s. = 9*l.* 10s; set down the 9 under the place of shillings, and the 10s left, being the half of 1*l.*, is to be considered as the half of a shilling, namely 6d., which is to be set down under the place of pence. Multiply both the figures in the place of pence into the shillings cross-wise, and add the two sums together thus 6s. × 10s. + 6s. × 19s. = 174s., say 174s. = 8*l.* 14s., place the 8 under the place of pence, and the 14 one place farther removed to the right. Multiply the pence into the pence thus—6 × 6 = 36, and say 36d. = 3s., put the 3s. under the 14s., and lastly add the products together into one sum thus—say 14 + 3 = 17, which place on the right of the pence, and put the figure under, making it $\frac{17}{20}$, and go through the other columns as in addition of money, which sum is the product of 9*l.* 19s. 6d. × 2*l.* 10s. 6d.

EXAMPLE.

£.	*s.*	*d.*	
9	19	6	
2	10	6	
9	19	0	
4	14	6	
0	9	6	
0	0	8	14
0	0	0	3
25	3	8	$\frac{17}{20}$

Note.—The $\frac{17}{2}$ are the $\frac{17}{20}$ of a penny.

O. P.

[There needs no Cocker "come from the grave," nor Wingate from Gray's Inn, to teach us accurate enunciation, or to regulate our opinions upon subjects of this nature; we nevertheless, in fairness to our correspondent, insert his letter, but at the same time we pronounce and prove his doctrine erroneous.

The multiplication of feet and inches by feet and inches, is only the working out of a corollary deduced from a geometrical proposition, viz.:—the numbers representing two adjacent sides of a parallelogram being multiplied together, will give the superficial content; but in the case of monies or any other things of different denominations and values, no geometrical demonstration can be obtained, nor does the proposition by fair interpretation contain any intelligible meaning. The following simple analysis will, or ought to, suffice.

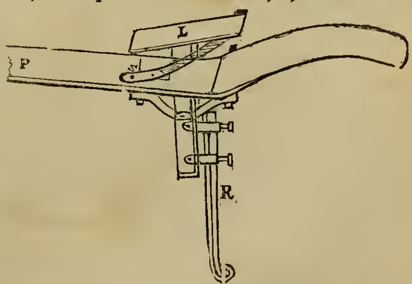
The square of a guinea is a guinea; that is to say, $1^2 = 1$ to whatever value or thing the unit may refer; but the square of 21 shillings is 22*l.* 1s., and the square of 1.05*l.* is 1.1025*l.* A pound and a shilling multiplied by a pound and a shilling, either means nothing at all, or it may be made to mean anything you please. Let x be a pound and y a shilling, then $\overline{x + y}|^2 = x^2 + y^2 + 2\,x\,y$, in which expression the whole absurdity is concentrated in the $2\,x\,y$, for x^2 must be 1*l.*, and y^2 1s.; but $x \times y$ must be greater than $y \times y$, and less than $x \times x$; it cannot therefore be either a pound or a shilling: now the involution of two unities can produce nothing but a unit of some kind, therefore no intermediate quantity between a pound and a shilling can be the result, consequently $x\,y$ has has no assignable value. Say $x = 1l.$ and $y = \frac{1}{20}$, we shall have $x^2 = 1l, y^2 = \frac{1}{400}$ and $2\,x\,y = \frac{1}{10} = 1\,\frac{41}{400} =$ 1.025.—Ed.]

JONES'S IMPROVED VELOCIPEDE.

To the Editor of the Mechanic and Chemist.

Sir,—In compliance with the wish of your correspondent "T. Ireland," I have sent you this plan of an improvement on the velocipede, and shall thank you for its insertion.

P, is the pole of the machine, L, is a lever



or foot-board on which the feet are pressed at every pull at the crank lever, which will impel the machine forward and over-

come the dead centres; s, is a spring to push the lever back, R, is a rod of iron which can be regulated to come to the ground by the two screws.

I remain yours truly,

J. JONES.

No. 1, Ratcliff Grove, St. Lukes.

MISCELLANEA.

Starch.—This substance, the Latin name for which is *amylum,* is the fecula of flour or potatoes. The general purposes for which starch is used, are too well known to need description, but it may not be so well known, that when roasted at a moderate heat, it is converted into a species of gum, which is much used by calico-printers. Starch chiefly exists in the friable parts of the vegetable substances, it abounds in the roots of tuberose plants, and also in the seeds of those of a graminivorous nature. It contains carbon, oxygen, hydrogen, and, according to M. Saussure, Azote in a small proportion. Under the process of distillation, starch gives out acetous acid, a trifling quantity of oil, and much of both carbonic acid and carburetted hydrogen gas. Starch obtained from potatoes differs in more ways than one from that made of flour, it is more brittle, requires less heat to turn it into jelly with water, and is also soluble in leys containing more diluted alkali.

WILLIAM V——E.

Fecula.—This is a substance obtained from different vegetables by grinding and afterwards steeping them in water; the part which after a time is precipitated or cast to the bottom is the fecula. This substance is distinguished from gum or mucas, by its insolubility in cold water.

WILLIAM V——E.

Silkworms.—It appears from the statement of a late writer, that it requires thirty thousand worms to produce five pounds of silk. If we reckon that at the present time a million and a half pounds are imported annually, it therefore seems that nine thousand millions of insects are kept constantly working in order to furnish the British with the raw silk, from which we make such a beautiful article of manufacture.

QUERIES.

How to make white varnish, or where it can be purchased? P. T.

What are the principles for setting out a pattern for an oblong copper vessel 7 inches by 9 on the top, 5 inches by $4\frac{1}{2}$ on the bottom, and 3 inches deep? Also, on what principle I must set out a pattern for an oval vessel 12 inches by 8 on the top, 6 inches by $3\frac{1}{2}$ on the bottom, and 5 inches deep? T. P.

[One of the objects of this work is to afford a medium of communication between practical men throughout this kingdom; and also between practical men and theorists; we therefore frequently leave questions of this nature in the hands of our numerous and intelligent correspondents. We of course could give an accurate geometrical solution of the above; but we must confess, that a "cunning artificer" would explain himself more familiarly to a brother workman, than probably we might be able to do. We will, however, if necessary, supply the answer, as clearly as geometrical accuracy will allow.—ED.]

1. The best method of denoting the density of the blast blown into a blast furnace? 2. Having some large water-tight cisterns to make of cast-iron plates screwed together, I should like to be informed of the best mode of making a cement for the joints? I believe there is nothing better than iron borings mixed with a solution of sal ammoniac, but I am unacquainted with the proper proportions of each. Perhaps some of your readers may suggest the introduction of some other ingredients by way of improvement. 3. The best work on metallurgy, and, if possible, the price? SHERWOOD.

ANSWER TO QUERY.

I would with all deference beg to suggest to "W. W.", who answered the copper-ball question (vide No. 60, New Series), that the solidity in inches of a body of copper multiplied by the decimals .32, gives the weight in lbs. avoirdupoise, which I think he will admit to be a much shorter and simpler method than the one he has adopted. The multiplier for cast-iron is .26.

SHERWOOD.

TO CORRESPONDENTS.

T. R. Bilbrough—*We thank him for his receipts, but fear they are not sufficiently accurate for publication.*

W. Evans.—*We shall be glad to see his plan for preventing accidents in descending the shafts of mines—it shall have our best attention.*

A. Subscriber.—*We know of no better material for the springs or tongues of the seraphine than good rolled brass. Brass wire is not near so good, nor so convenient. We beg leave to suggest to correspondents who sign "a subscriber," the convenience of adopting some distinguishing name or letter, in order to prevent mistakes.*

A Correspondent Clements Inn *is not sufficiently explicit to make his meaning understood.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 71, NEW SERIES.	SATURDAY, JAN. 18, 1840. PRICE ONE PENNY.	No. 192, OLD SERIES.

SELF-ADJUSTING LETTER-BALANCES.

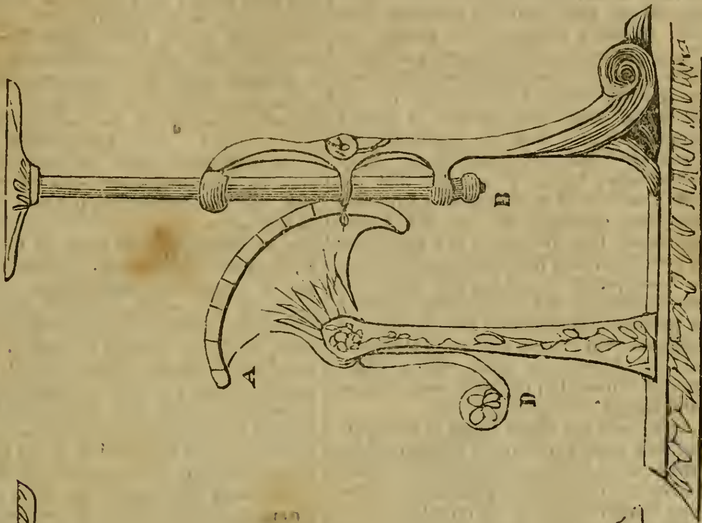

Fig. 1.

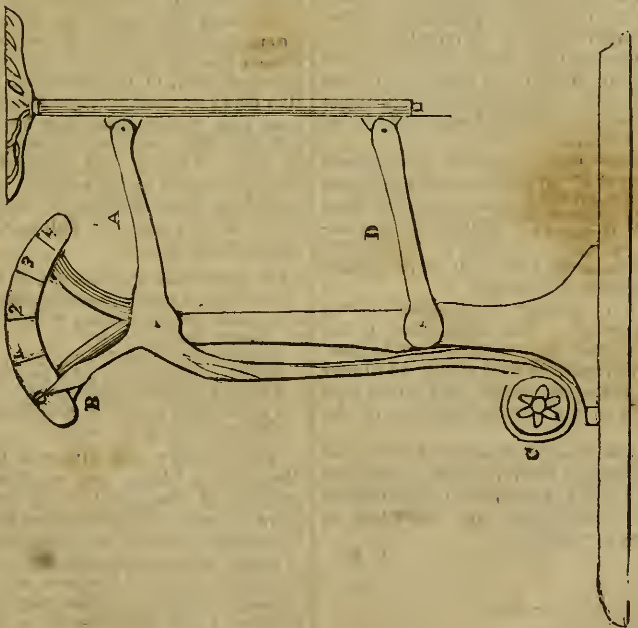

Fig. 2.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

SELF-ADJUSTING LETTER-BALANCES.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—In offering the above sketch (fig. 1) of a letter-balance, I beg to observe, that the only advantage it is presumed to possess over the very neat and scientific plan of Mr. Riddle's, consists in a greater facility of placing and withdrawing a letter, which in many mercantile and other offices, having frequent occasion for its use, will be of some importance, as saving time, &c. I also send the enclosed plan of another kind, invented by me above a week ago; but as it appears that the same principle of a subspiral spring has since been brought out by Mr. Lund, (registered 17th instant) a few days after my own invention had been consummated (for I succeeded in making one which answered tolerably well on the 14th instant), my particular description may perhaps be dispensed with; at all events, Mr. Editor, you can insert the most recent affair, fig. 1, the invention of this present day, as being simple, facile, and correct.

At A, near the upper angle of the quadrant, is a small perforation, through which a silken cord, or other material not likely to give or to stretch, is passed, and after being conducted round the circular portion of the quadrant (in which there must be a groove), is brought in contact with the upright shaft, and after passing through another aperture at the lower end, is secured by a knot.

A letter being placed on the cup will cause the shaft to descend, and the degree or weight will be pointed out by the index at C. D is a weight of about three quarters of an ounce, or such as to admit of two ounces being indicated on the graduated quadrant, if required.

Fig. 2 is another application of the same principle. The upper arm, A, the index, B, and the weight, C, are immovable with regard to each other. The lower arm, D, is merely passive, and serves only to preserve the perpendicularity of the shaft.

The sole object of these plans is to avoid the swinging holders, which cause too much vibration, and are also inconvenient where frequent use and quickness of weighing are required.

J. B.

ON THE CIRCULATION OF THE BLOOD.

(Continued from page 156.)

The loss by insensible perspiration is much greater than by what is commonly termed perspiration, which is, in fact, only an accumulation of the former. If you look closely at your hand when it is warm, you will perceive, even with the naked eye, on the little ridges which run across it, rows of very minute orifices. It is through these that the perspiration is given out, and they are as numerous over the whole surface of the body as they are on the hand. The perspiration which oozes from them when the hand is warm may be seen to glitter brilliantly in the sun, and the little spots, not half so large as the point of a very fine needle, shew how exceedingly small must be the tubes from which they proceed. Another example of insensible perspiration may be found in the peculiar odour which distinguishes different individuals and animals, as it is supposed to depend principally on this cause. Most animals have a distinct odour peculiar to themselves, and by which, indeed, they are tracked when hunted; and creatures that have a fine sense of smell can readily detect different persons by this means alone. A dog will often trace his master for miles entirely by scent, although most persons might be able to discover no odour. It is in consequence, also, of the insensible perspiration being so much greater in some persons than others, that they are thinner, and that some require a greater quantity of food. Anxiety and thought have a great influence in the matter. You will remember how Shakspeare notices this fact. In the play of Julius Cæsar, he makes Cæsar say—

> " Let me have men about me that are fat,
> Sleek-headed men, and such as sleep o' nights.
> I like not yonder Cassius; he hath a lean and hungry look;
> He thinks too much.
> Would he were fatter! but I fear him not:
> Yet if my mind were liable to fear,
> I do not know the man I should avoid
> So soon as that spare Cassius."

The remarks well illustrate the physiological fact I have just mentioned, that persons of thoughtful mind lose much more by insensible perspiration than those "sleek-headed men, who sleep o' nights."

I may, perhaps, mention, before quitting this topic, that a "common cold" is the consequence of any sudden stoppage of the function I have been describing; and you will understand, therefore, why warm,

dilutent drinks are given to persons suffering from this cause; they excite the blood-vessels of the skin to action, and by renewing the insensible perspiration, relieve the cold.

Now as this waste of the body, on which I have been dilating, is continually going on, and as persons in health do not vary much in size and weight,—unless, indeed, in the case of young persons, to grow larger,—it is evident there must be some continual source from which the loss can be supplied. This is the blood; and its circulation is the means by which the food we eat, after it has been converted into "the living tide," is made to contribute to our nourishment and support.

A second grand use of the circulation is, to supply the different organs with vitality—with life. We find, for instance, that the brain is largely supplied with vessels that convey the blood to it almost direct from the heart; and if these vessels are tied, or the supply of blood in any way stopped, death is the almost instantaneous result. Nor is it alone necessary that blood only should be so supplied—it must be *arterial* blood, purified by contact with the air in the lungs, from the impurities it received in its passage through the body. Unless a continual and fresh supply of this fluid is kept up, the animal immediately perishes. For instance, when criminals in this country are executed, death is most frequently produced by suffocation—by the want of a supply of fresh air to purify the vital fluid, before it is sent from the heart upwards to the brain. And when persons die from inhaling impure gases, or from drowning, the cause in each case is the same. When the circulation also is interfered with by the vessels being pressed upon, so that the passage of the blood is impeded in its progress through the veins from the brain, apoplexy is not unfrequently produced; and many gentlemen who tie their cravats a great deal tighter than is necessary, are not, perhaps, aware, that they are putting their lives in danger by so doing. Besides the brain, every other part of the body requires a constant fresh supply of the living stream, in order to preserve it in a state of health, though death does not so immediately ensue from any irregularity in such cases as in the case of the brain. If, however, the supply be cut off. from the arm, for instance, mortification in a very short time ensues; in other words the part dies, and it is only by causing a good healthy current to be continually distributed to every part, that the body, as a whole, can be maintained in a state of health, and the individual be rendered capable of enjoying the good things of this life, which has been allotted as his portion. This is one lesson, therefore, which, I trust, will be borne in mind; and I hope that, having thus shown you the importance of the circulation in a few instances, I shall have rendered you desirous of knowing how it may be maintained in a healthy state, and that you will also be better capable of understanding and deriving entertainment from the description I am about to give of the organs by which the circulation is carried on both in man and the lower classes of animals, and of the vital means by which the circulation is effected.

As I have just stated, it is necessary in the human body that the blood, before it is sent out from the heart to the different organs, should be purified by being brought into contact with the atmosphere in the lungs, during the act of respiration. In man, therefore, there are, properly speaking, two distinct circulations,—one from the heart through the lungs, and back again by another set of vessels; and the other from the heart over the whole body, and back again to the same organ. In all the higher class of animals which respire the same as we do, there is the same double circulation; but in the lower orders of animals it is variously modified. Some creatures require only a small portion of their blood to be purified, and in others we can perceive no distinct organs whatever for effecting this object. I will endeavour to give you some idea of the comparative anatomy of the circulating organs, by reference to a few well-known living creatures.

The first appearance of organs for the circulation, is simply a tube passing from one end of the body to the other in the class of animals where this structure is perceived. This tube is called the *dorsal vessel*, because it is found along the back of the animal, and it appears to possess the power of contracting and dilating, so that its contents may be pressed forward. It is a curious fact, however, that the dorsal vessel appears to have no connexion at either end with vessels through which the fluid it contains could be passed; and it was formerly supposed that the blood of the creature was merely kept moving backwards and forwards in this tube, without any progressive movement. Dr. Roget, however, states, that it has been discovered the fluid does pass out at one end of the vessel, and passing through the substance of the animal's body, enters the tube at the other end. The dorsal vessel may be observed in the caterpillar, the

spider, and the earthworm, and if the creature be attentively examined for some time, you will observe a series of contractions and dilitations along its back, which are, in fact, the action of the dorsal vessel.

(*To be continued.*)

ON LIFE ASSURANCE.

(*Continued from page* 153.)

In all financial combinations where a chance of great gain is promised, there must necessarily be a corresponding risk of loss; since it is with the money of those who pay more than they receive, that others are enabled to receive more than they pay. But so extraordinary are the circumstances of assurance, that it is always desirable to lose, and nothing short of a great calamity will entitle the insured to gain. Who, indeed, ever complained of his house and property being preserved from fire, because that circumstance enriched the insurance office? Or who, for a similar reason, would desire a premature death?

If the principles of insurance were more generally known and adopted, it would, no doubt, be considered one of the first duties of the father of a dependant family, to provide, by assurance, against one, at least, of the grievous consequences of the ever-impending bereavement of death. "The theory of insurance," says M. De Morgan, "is, in fact, in a limited sense, and a practicable method, the agreement of a community to consider the goods of its individual members as common. It is an agreement, that those whose fortune it shall be to have more than average success, shall resign the overplus in favour of those who have less. And though, as yet, it has only been applied to the reparation of the evils arising from storm, fire, premature death, disease, and old age, yet there is no placing a limit to the extensions which its application might receive, if the public were fully aware of its principles, and of the safety with which they may be put in practice."

Unfortunately, however, the practical execution of these theories is attended with much difficulty and danger. It appears that many of the recently-established companies have already "broken up;" and such is the extent to which the system of puffing is carried, even by really respectable companies, that it is difficult to discover which of them is most secure from a similar fate. The Secretary of the Provident Life Office has the following in an advertisement in 1839:—"In 1806 there were only *eight* life offices in London, including the Provident. Since then their number has increased to nearly *one hundred;* of these, about *thirty* have broken up, and *sevcnty-two* is their number in the London Directory for the present year."

We cannot undertake the delicate and invidious task of recommending certain offices as more secure than others; we can only speak of general principles, and leave their application to our readers; but we wish particularly to caution them against puffing prospectuses and advertisements. Professor De Morgan, speaking of the present system of puffing, says, "Of one thing I am certain, that the magnificent style in which the prospectuses frequently indulge, might often remind their readers of the unparalleled benefits which are promised by another description of traders, who vie with each other in describing the rare qualities of their several *blackings.* If there be in this country a person whose ambition it is *to walk in the brightest boots to the cheapest insurance office,* he has my pity; for, grant that he is ever able to settle where to send his servant,—and it remains as difficult a question to what quarter he shall turn his own steps,—the matter would be of no great consequence, if persons desiring to insure could be told at once to throw aside every prospectus which contains a puff: unfortunately this cannot be done, as there are offices which may be in many circumstances the most eligible, and which adopt this method of advertising their claims. If these pompous announcements be intended to profess that every subscriber shall receive more than he pays, their falsehood is as obvious as their meaning; if not, their meaning is altogether concealed."

(*To be continued.*)

CEMETERIES OF THE METROPOLIS.

In our last number we gave a plan and description of Sir Christopher Wren's grand project for rebuilding the City of London after the conflagration of 1666; and it was shown that several of our recent improvements had been conceived and recommended by that truly great man. One of the objects he proposed, was the removal of all grave-yards and other receptacles of the dead, to a proper distance from the city; he was, however, frustrated in his enlightened endeavours by the superior power of prejudice—that formidable barrier to all amelioration, powerful in all nations and in all ages, but impreg-

nable to reason, when surrounded by the stagnant moat of ignorance; but if prejudice is stronger than reason, there is a power superior to them both—that power is interest. Before, however, we proceed to combat the resistance of prejudice, we must, by unanswerable argument, prove that our cause is really that of reason: this task is easier than agreeable; but we deem it essential to the health of the metropolis that so intolerable a nuisance should be removed, and we shall point out our reasons for recommending our readers to exercise their utmost influence to promote so desirable an object. We have more to say upon this subject than our limited space will at present allow; and shall therefore defer till another occasion the more complete development of our sentiments. The following extracts from Mr. Walker's "Gatherings from Grave-yards," will be sufficient to attract the attention of citizens to this very serious subject:—

"*Clement's-lane.*—It is surrounded by places, from which are continually given off emanations from animal putrescence. The back windows of the houses on the east side of the lane look into a burying ground called the 'Green ground,' in Portugal-street, presently to be described: on the west side the windows (if open) permit the odour of another burying place—a private one, called Enon Chapel—to perflate the houses; at the bottom—the south end—of this Lane, is another burying place, belonging to the Alms' Houses, within a few feet of the Strand, and in the centre of the Strand are the burying ground and vaults of St. Clement Danes; in addition to which, there are several slaughter-houses in the immediate neighbourhood; so that in a distance of about two hundred yards, in a direct line there are four burying grounds; and the living here breathe on all sides an atmosphere impregnated with the odour of the dead.

"*Burying Ground, Portugal-street.*—The soil of this ground is saturated, absolutely saturated, with human putrescence. * * The effluvia arising from this ground, at certain periods, are so offensive, that persons living at the back of Clement's-lane, are compelled to keep their windows closed; the walls even of the ground which adjoins the yards of those houses, are frequently seen reeking with fluid, which diffuses a most offensive smell.

"*Enon Chapel.*—This building is situated about midway on the western side of Clement's-lane; it is surrounded on all sides by houses, crowded by inhabitants, principally of the poorer class. The upper part of this building was opened for the purposes of public worship about 1823; it is separated from the lower part by a boarded floor: this is used as a burying place, and is crowded at one end, even to the top of the ceiling, with dead. It is entered from the inside of the chapel by a trap door; the rafters supporting the floor are not even covered with the usual defence—lath and plaster. Vast numbers of bodies have been placed here in pits, dug for the purpose, the uppermost of which were covered only by a few inches of earth; a sewer runs angularly across this 'burying place.' * * Soon after interments were made, a peculiarly long narrow black fly was observed to crawl out of many of these coffins; this insect was observed on the following season to be succeeded by another, which had the appearance of a common bug with wings. The children attending the Sunday School, held in *this chapel*, in which these insects were to be seen crawling and flying in vast numbers, during the summer months, called them 'body bugs,'—the stench was frequently intolerable.

"*St. Clement's Church, Strand.*—There is a vault under this church called the '*Rector's Vault*,' the descent into which is in the aisle of the church near the communion table, and when opened, the products of the decomposition of animal matter are so powerful, that lighted candles passed through the opening into the vault, are instantly extinguished; the men at different times employed, have not dared to descend into the vault until two or three days had elapsed after it had been opened, during which period the windows of the church also were opened to admit the perflation of air from the street to occupy the place of the gas emitted; thus a diluted poison is given in exchange from the dead to the living in one of the most frequented thoroughfares of the metropolis. * *

"*Drury-lane Burying Ground* belongs to the parish of St. Martin's-in-the-Fields; many thousands of bodies have been here deposited. The substratum was, some years since, so saturated with dead, that the place 'was shut up' for a period. The ground was subsequently raised to its present height—*level with the first floor windows surrounding the place*, and in this superstratum vast numbers of bodies have, up to this period, been deposited.

"*Buckingham Chapel*, situated in Palace-street, about three minutes' walk from Buckingham Palace.—There are two vaults and a burying ground belonging to this chapel; one of the vaults is *underneath very large school rooms for boys and*

girls, and the other is *underneath the chapel;* the entrance to these vaults is through a trap-door, in the passage, dividing the school-rooms from the chapel; steps lead to the bottom of the building; on the right is the vault underneath the schools. * * The vault is supported on wooden pillars, and there is only one grating, which fronts the street, to admit light and air; the floors of the school-rooms, white-washed on the under surface, form the roof of the ceiling to the vault—it is no difficult matter to see the children in the lower school-room from this vault, as there are apertures in the boards sufficiently large to admit the light from above. This place is spacious, but very low;—the vault on the left, under the chapel, is about the same size as that under the schools, though much lower. I was assured that the ground was so full of bodies, that there was difficulty in allotting a grave; the roof of this vault is formed by the under surface of the floor of the chapel; it is whitewashed, the light passes through it; the smell emitted from this place is very offensive. In the vault underneath the chapel there are piles of bodies placed in lead; the upper ones are within a few inches of the wooden floor. On a level with the chapel, and behind it and the school rooms, is the burial ground, which is much crowded,—most of the graves being full seven feet deep, and nearly filled to the surface with the dead; the ground is raised more than six feet from the original level,—formed only by the debris of mortality. No funerals are permitted on a Sunday."

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 92.)

The mansion is situated on a fine sloping lawn, with the principal front facing the south; this measures 916 feet from east to west, and consists of a centre, connected by elegant colonnades, to two pavilion wings, of the same height as the centre, a projecting pediment supported by six beautiful Corinthian columns, and two pilasters, forms the grand entrance; from hence, the descent to the lawn is by a flight of 31 steps, at the bottom of which, there is on each side a massive stone lion finely executed. The interior displays all that the power of art, added to an exquisite refinement of taste, could possibly produce; expense does not appear to have ever entered the mind while forming and decorating this superb mansion. Its various apartments are of noble dimensions, and contain a vast collection of paintings of great merit and value, besides several curious specimens of the antique, all of which are judiciously disposed in appropriate situations. The library is suitably furnished; it contains about 10,000 volumes, besides a number of unpublished writings, including many Irish manuscripts, and the whole of the works of the celebrated Charles O'Connor; but notwithstanding the various claims to notice which almost all the apartments possess, the saloon appears to deserve most attention, on account of its antique grandeur; this is paved with the finest Carara marble, in squares of four feet each; it contains a number of elegant scagliola columns, in imitation of Sicilian jasper, with white marble bases and capitals; twelve niches are occupied by large statues and candelabra of exquisite workmanship, besides which here is a frieze and cornice in alto relievo, by that eminent artist Signor Valdre. This apartment, with all its combined decorations, is transcendently magnificent; but when lighted, and filled with the melodious strains that issue from a concealed music-gallery, the effect is considerably heightened.*

Brackley, a market town in Northamptonshire, is situated upon a descent near a branch of the Ouse, seven miles and a half from Buckingham, and sixty-four from London. It is a place of very great antiquity, and was a flourishing town in the time of the Saxons. It attained considerable commercial importance after the Conquest, but has since decayed into comparative insignificance, and was disfranchised by the Reform Bill. Some vestiges of its former greatness may still be traced; and these, illuminated by the expiring taper of tradition, are the only testimonies of its departed grandeur. So imperfectly, indeed, is its history known, that historians cannot agree in deciding whether it first sent members to Parliament in the reign of Edward I., or in the reign of Henry VIII. It contains two churches, a hospital, a free school, and a market hall, with a good market on Wednesday.

To the Editor of the Mechanic and Chemist.

Sir,—Having observed in your last number of the "Mechanic and Chemist," a notice of a society formed at Sheffield for

* For a portion of the preceding description of Stowe, we are indebted to Britten and Brayley's "Beauties of England and Wales," and to several other publications.

the study of mechanics and chemistry, and being desirous of assisting in the formation of such a society, I have ventured to request the favour of your inserting this letter to the readers of your valuable magazine in this neighbourhood (Charing-Cross), for the purpose of forming a society on the same principle as that at Sheffield. The reason why I propose such a spot is, because I am so situated that the narrow limits of an apprentice's leisure-hours will not admit of my attending one situated any great distance from my situation; and I have no doubt that there are many of your readers in the neighbourhood who are placed in a similar situation and of the same opinion, and who, I have no doubt, will very readily assist in the formation of a society of the kind. Hoping, therefore, that in a short time such societies may be spread all over England, I beg to subscribe myself,

Your obedient servant,

J. C.

21, Great Newport-street.

MISCELLANEA.

To make Coloured Fires.—Blue. 1 sulphuret of antimony, 2 sulphur, 4 nitre.

Crimson.—1 sulphuret of antimony, 1 sulphur, 1 chlorate of potash, 5 nitrate of strontian.

White.—1 coal, 1 sulphur, 4 nitre.

Yellow.—1 coal, 1 sulphur, 1 lamp black, 1 rosin, 4 nitre.

Green.—1 sulphur, 1 sulphuret of antimony, 2 chlorate of potash, 4 nitre, 5 nitrate of barytes. Or, 1 sulphur, 1 sulphuret of antimony, 5 nitre, 5 nitrate of barytes. Or, 1 chlorate of potash, 1 sulphur, 1 sulphuret of antimony, 10 nitrate of barytes. Or, 1 lamp black, 4 sulphuret of antimony, 5 chlorate of potash, 13 sulphur, 80 nitrate of barytes. T. Kentish.

Mode of getting rid of Snails.—These creatures are passionately fond of bran, or the outward skin of wheat. When this food is placed out for them, they leave it as seldom as possible, and when they do retire for a time, they return most eagerly to again feed on it. This suggests a mode of freeing any piece of ground of insect. You have only to place over little heaps of bran, pieces of broken pipes, or pots, or vessels of any kind, which may shelter the food from the rain, and your work is done. The snails will congregate below, and you can in a short time destroy vast multitudes of them.

Growth of Fish.—The rapid growth of fish is very extraordinary. There were three pike taken out of a pond, two of which weighed 36lbs. each, and the other 35lbs. The pond was fished every seven years, and supposing that store pike of six or seven pounds' weight were left in it, the growth of the pike must have been at the rate of four pounds a year. Salmon, however, grow much faster, for it has been ascertained that grisle, or young salmon, of two and a half to three pounds' weight, have been sent to the London markets in the month of May, the spawn from which they came having only been deposited in the preceding October or November, and the ova taking three months to quicken. It has also been ascertained by experiment, that a grisle which weighed six pounds in February, after spawning, has, on its return from the sea in September, weighed thirteen pounds; and a salmon fry of April will in June weigh four pounds, and in August six pounds.—*Gleanings of Nat. Hist.*

The Larch.—This species of fir, or pine, which is now seen in every gentleman's plantation, was accidentally brought to Scotland about a hundred years ago. A Mr. Menzies, while in London in 1737, hearing of a beautiful pine shrub recently imported, procured four plants, two of which he gave to the Duke of Atholl, and may be called the parents of all the larch in the kingdom; a third to a gentleman of Monzie, and kept the fourth for himself. The larch has proved a valuable acquisition to the produce of many barren moors in the Highlands of Scotland, where the climate is found more favourable for this species of pine than in the plains.

Cork.—Many persons see corks daily used, without knowing whence come these exceedingly useful materials. Corks are cut from large slabs of bark of the cork tree, a species of the oak which grows wild in the countries in the south of Europe. The tree is generally divested of its bark at about fifteen years' old; but before stripping it off, the tree is not cut down, as in the case of the oak. It is taken while the tree is growing; and the operation may be repeated every eighth or ninth year, the quality of the cork continuing each time to improve as the age of the tree increases. When the bark is taken off, it is singed in the flame of a strong fire; and after being soaked for a considerable time in water, it is placed under heavy weights, in order to render it straight. Its extreme lightness, the ease with which it may be compressed, and its elasticity, are properties so peculiar to this substance, that no efficient substitute for it has yet been discovered. The valuable properties of cork were known to the Greeks and Romans, who employed it for all the purposes for which it is used at present, with the exception of stopples for bottles—the ancients mostly employing cement for closing the mouths of vessels. The Egyptians are said to have made coffins of cork, which, being spread on the inside with a resinous substance, preserved dead bodies from decay. In modern times, cork was not generally used for stopples to bottles till about the close of the 17th century, wax being till then chiefly in use for that purpose. The cork imported into Great Britain is brought principally from Italy, Spain, and Portugal. The quantity annually imported is about 5000 tons.—*Encyclopædia.*

Removal of a Bog.—On Saturday last, this hitherto peaceable town, Kanturk, was thrown into the greatest state of excitement. It appeared that about three hundred acres of Colonel Longfield's bog, at Farrandoyle, had, truant-like, gambolled through the country, a distance of four miles, and was about paying a Christmas visit to the Kanturk folks. The scene was terrific. Onward moved the mighty and over-

whelming mass, carrying destruction in its course. Occasionally it moved in a compact body; sometimes, on meeting obstructions, it rose in augry surges like the ungoveruable sea, elevating enormous pieces of bog-wood. The course of the Brogeen stream was soon impeded, as the bog got into the valley, and the water having become considerably swollen and accumulated behind, forced on the whole mass with fearful violence, and dispersed the bog-stuff and timber to a considerable distance up the acclivities. It is to be regretted that bog timber, to the value of at least 500*l.*, passed off into the Brackwater, the people being unable to come at it on account of the great depth of the surrounding bog-stuff; and it is calculated that no less than 1200 acres of meadow and pasture land have been covered, at an average of ten feet. The first movement of the bog was observed by Mr. R. Swaine, of Kanturk, who was shooting on it at the time, and who narrowly escaped being lost; Mr. Swayne having got on *terra firma*, ran with all his might to give warning of the danger; but his speed was unequal to the task, and one house was overwhelmed before he could call out; fortunately, however, no lives have been lost. The bog is still moving, and, it is thought, will continue so for many days.—*Cork Standard.*

Smoking in Germany.—The propensity of smoking is declared by the German physicians to be actually one of the most efficient causes of the German tendency to diseases of the lungs. In point of expense, its waste is enormous. 50,000 boxes of cigars have been consumed in a year, each box costing about 3*l.*—150,000*l.* puffed into the air! This plague, like the Egyptian plague of frogs, is felt everywhere and in everything: every eatable and drinkable, all that can be seen, felt, heard, or understood, is saturated with tobacco; the very air we breathe is but a conveyance for this poison into the lungs. One mighty-fumigation reigns, and human nature is smoke dried by tens of thousands of square miles. It is computed, that of twenty deaths of men between 18 and 35, ten originate in the waste of the constitution by smoking. The universal weakness of the eyes is attributed to the same cause of general nervous debility. Tobacco burns out their blood, their teeth, their eyes, and their brains; turns their flesh into mummy, and their mind into metaphysics.—*Hamburgh Paper.*

QUERIES.

Can any of your correspondents inform me where I can obtain the following articles at a cheap rate? I do not wish to have highly-finished workmanship, only requiring the outside to be smoothed, but of course to be true in the bore:—Two cylinders, pistons, and rods; also slide valves, the same size and shape commonly used in the present models?

A Young Beginner.

1. The best and cheapest mode of constructing an oxyhydrogen microscope?

2. The best method of gilding ivory? I have tried that given in No. 3 (N. S.), but can produce nothing but a brown stone.

Felix Weiss.

Can any of your readers inform me of the best, cheapest, and most simple method of constructing a miniature working model of a steam engine, and where I can get the materials; and also what the spindle is made of belonging to the cheap electrical machine described in No. 37?

Juvenile.

TO CORRESPONDENTS.

A Constant Reader.—*Aromatic fumigating pastils consist chiefly of cascarilla (cortex cascarillæ), which may be mixed with any convenient combustible substance. The bark alone, if well dried, will answer the purpose without any preparation.*

Electron *will hear from "Tyro Chemicus" all we desire to say, and, indeed, all we can say upon the subject of his two last communications. We cannot even conjecture the purport of the letters which he supposes were sent to our office, but which, we repeat, have not been received.*

Sherwood *has not multiplied pounds by shillings, but pounds by fractions of a pound. It is true that a shilling is, in value, one-twentieth part of the value of a pound; but it is also an integral sum in itself, and may as properly be compared with a crown or a guinea, as with a pound. We repeat that the operation is impossible, and trust that our correspondents will pardon us if we decline inserting any more fruitless and utterly hopeless attempts to do that which is impossible to be done.*

C. E. (Coventry) *will receive the best information we can obtain on the subjects of his queries.*

H. W. *shall have our earliest attention.*

Our next number being a double one, we shall be enabled to answer many querists omitted this week, owing to want of space.

Errata.—At page 150, first column, line 45, read, "is equal to the cube of its diameter," &c.; and next line $\frac{8^3 \times .5236}{2} = 8_3 \times .2618 =$ &c.; and since a pound of water contains 27.7274 cubic inches, hence $\frac{8^3 \times .2618}{27.7274} =$ the weight of the water at once.' 1000 ounces to a foot of water, also, is only an approximation, in round numbers.—Second column, line 5, read "lies between 101 and 102;" and next line

$\frac{89^5}{101^4} = 53.661$; and, four lines lower,

$$\frac{89.39^5}{101.39^4} = 54.008.$$

W. W.

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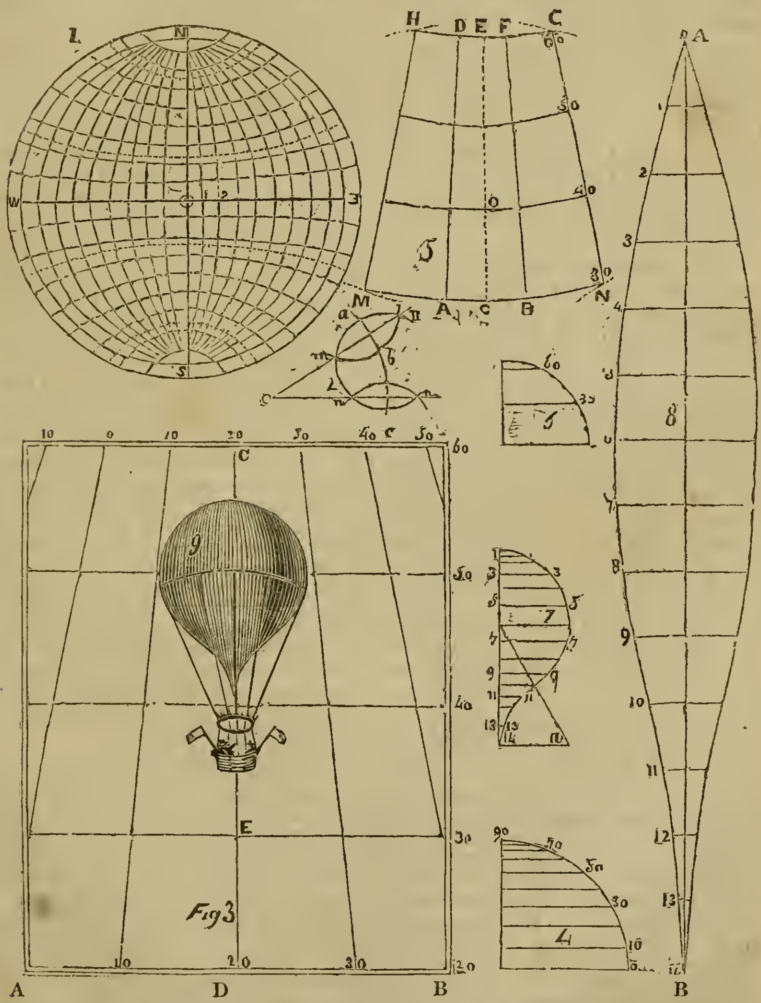
PROJECTION OF MAPS, GLOBES, BALLOONS, PARACHUTES, ETC.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PROJECTION OF MAPS AND BALLOONS.

(See Engraving, front page.)

A MAP is a projection of the surface of the globe upon a plane. In this, three things are necessary :—the correct representation of the circles, the proportional magnitudes of places, and their relative positions or bearings. Only two of these, however, can be effected at once, on account of the difference between a plane and a convex superficies. The usual projections are the orthographic, the stereographic (Mercator's), and the globular. In the orthographic, the circles towards the outsides are too near ; in the stereographic, too distant; in Mercator's, the magnitudes of places are extravagantly distorted, and the poles are omitted, but the bearings are shown correctly. The globular, which we shall first treat of, represents equal spaces on the earth by equal spaces on the map, as nearly as any projection will allow.

Globular Projection.

From the centre, O, fig. 1, with any radius, O N, describe the circle, N E S W, in which draw the diameters, N S, E W, crossing each other at right angles. Divide each of the lines, O N, O E, O S, O W, into nine equal parts. Likewise divide each quadrant into nine equal parts ; there will then be given three points, N 1 S, N 2 S, &c., through which to describe the arcs, or meridians and parallels, as shown in the diagram. The method of performing this is represented in fig. 2. Let *a b c* be three points through which a curve is to pass ; from *b*, with any radius describe the arc, *n n*, *m m ;* from *a*, with the same radius, cross it in *m m ;* and from c, with the same radius, cross it in *n n*. Through *m m*, *n n*, draw straight lines, meeting each other in *o ;* *o* is the centre of the circle required, and *o a*, *o b*, or *o c*, the radius.

To project a Map of a portion of the Earth, in which the Meridians and Parallels are to be Right Lines.

Draw a base line, A B, fig. 3, in the middle of which erect the perpendicular, C D ; along this, set off any convenient distance, D E, the requisite number of times, and draw the parallels. With D E, as a radius, describe the quadrant, fig. 4, which divide into nine equal parts, and through the points of division draw lines parallel to the base. The bottom parallel of fig. 3 being 20, take off the length of the cosine 20, fig. 4, and set it along A B, fig. 3, on each side of D, towards A and B. The top parallel being 60, take the length of the cosine 60, fig. 4, and set it off from C, fig. 3, to the right and left. Draw the meridians to the corresponding divisions at top and bottom, and the map is prepared for receiving the countries. If it be required to curve the meridians, take off the *intermediate* cosines. For dividing the quadrant, a protractor is the most convenient instrument. This any one may readily construct for himself, with a piece of card board.

To project a map in which the meridians are to be right lines, and the parallels curves, draw a base line, A B, fig. 5, in the middle of which erect the perpendicular, C E, and set off upon it any distance, C O, the requisite number of times. With the same distance, C O, describe the quadrant, fig. 6, which divide into nine equal parts, and draw the necessary cosines. A B, fig. 5, being the parallel of 30, take off half the cosine 30, fig. 6, and set it on each side of C, to A and B, fig. 5 ; do the same with half the cosine 60, for the top, D F. Draw the lines D A, F B. From A and B, as centres, with the transverse radius, A F, describe the arcs, J H G ; and from D and F, as centres, with the same radius, sweep the arcs, M N. From A and B, as centres, with the distance, A B, or cosine 30, cross the arcs, M N ; and from D and F, as centres, with the distance, D F, or cosine 60, cross the arcs, H G. From the points of intersection draw the lines, H M, G N, and so proceed as often as necessary. The parallels in this case will be parts of immense polygons, which must be rounded off by hand, or by a bow of whalebone or watch-spring. In large maps, where the radiuses are too large for compasses, this method will be found very convenient. We have thus shown three methods ; 1st, where the meridians and parallels are both straight lines ; 2nd, the parallels straight, and the meridians curved ; 3rd, the parallels curved, and the meridians straight. The case in which both are curved, will be treated of hereafter.

To project Globes, Balloons, &c.

The first thing to be determined upon is the number of gores, and the intended circumference. The latter being divided by the former, gives, of course, the middle breadth ; the breadths in other parts will be as the cosines, as is evident upon reflection, for the cosines become the successive radiuses of the concentric lesser circles. Then since the gore is to reach half round the globe, its length will be half as many times its breadth as there are gores. Thus, if there be forty gores, the length

will be twenty times the breadth, and so on. This is for a perfect sphere or spheroid, the latter of which is projected from an ellipse, as will be hereafter explained. But a more elegant shape for an air balloon is shown in fig. 9, and in this the length will be one-sixth greater. Montgolfier, or fire-balloons, which require a wider mouth, are the same as globes, with the exception of the bottom quadrant, which is bent outwards for the purpose of receiving the rarefying substance. The most convenient number of gores for balloons not more than ten feet diameter, or ten yards circumference, is twelve. In this case the middle width contains as many inches as the circumference measures feet. Suppose it be required to construct a balloon twelve feet in circumference, the gore will then be twelve inches. With half this for a radius, describe a semicircle, fig. 7; divide the top half into six equal parts, in the points 1, 2, 3, 4, 5, 6; carry four of them round to 7, 8, 9, 10. Draw a straight line from the centre through 10 to *a*, making the distance from 10 to *a* equal to the radius, from which as a centre describe the reverse arc, and carry down four more divisions in the points 11, 12, 13, 14. Draw a straight line, A B, fig. 8, along which set off the radius used in fig. 7, fourteen times, and erect perpendiculars, as shown in the diagram. Measure the distance from 1 to 1, fig. 7, and set it on each side of the straight line to 1 1, fig. 8. Do the same with the distances 2 2, 3 3, &c., and connect the extremities with straight lines. Fig. 8 will be the shape of the gores, of which there are to be twelve. Montgolfiers we shall explain in a subsequent paper. If constructed of tissue-paper, the air-balloons must be previously varnished, as directed at page 70. For the details of pasting, &c., the reader is referred to my "Holiday Companion," mentioned at page 90, in which he will meet with every information requisite to ensure success. By taking the top section of fig. 8, we have the gores for a parachute or umbrella; the bottom section furnishes the more graceful parasol. The table given at page 115 contains the natural cosines, calculated to a radius of 60. The reader will obtain them by multiplying the common tables by 60; also the secants, which he will require hereafter. He must be particular not to confound them with the *logarithmic* cosines and secants. A future paper will explain the method of projecting maps and balloons, without the intervention of tables or diagrams, by means of the sector, which instrument is described in my "Treatise on a Box of Instruments and the Slide Rule," mentioned at pages 34 and 116 of the present work.

T. Kentish.

ON LIFE ASSURANCE.

(*Continued from page* 162.)

A writer in the *Quarterly Review* for last October, commenting on the prospectus of the "Independent and West Middlesex Assurance Company," says,—

"Take just one example, from the terms of this advertisement, to give an idea of the liberality of the 'Independent and West Middlesex.' A person from thirty to forty years of age, say thirty-four, deposits 100*l.*, for which he is to receive an annuity of 8*l.* per annum. He insures his life for 100*l.* at a premium of 2*l.* per cent. per annum, and receives, therefore, a clear annuity of 6*l.* per cent. in money. Allow the office to make 4*l.* interest on the 100*l.* deposited (which is more than any of the government securities will give), and consequently the company, by paying 8*l.* and receiving 6*l.*, makes an annual sacrifice of 2*l.* per cent. during the life of the annuitant, without the possibility, as appears to us, of redeeming the loss, for on his death the 100*l.* deposited must be repaid to the representatives, being the sum assured. What mystery there may be in this transaction it is impossible for us to unriddle. But we may observe, that the liberal annuity tables of government for the age of thirty-four, when the price of consols is 93, give an annuity for 100*l.* stock of 5*l.* 3*s.* 7*d.*, or, which is the same thing, for 100*l.* sterling, 5*l.* 11*s.* 4*d.*, making thus, by this office, a further 'sacrifice to public benefit' of 2*l.* 8*s.* 8*d.* per cent. Can this deceive any one with comprehension beyond that of an idiot? Can any one be simple enough to imagine that James Drummond and James Alexander, of Charing Cross and Carlton House Gardens (names which figure in the list of its Directors), are to be found in Baker-street, opposite the Bazaar?

"This Independent Company, established opposite the Bazaar in Baker-street, affords almost a solitary instance of an office of this kind being removed to a great distance from any other; for it is a curious feature in the localities of these institutions, to find the new offices always endeavouring to cluster round the old ones. Thus, in New Bridge-street and Chatham-place, we find no less than fifteen brisk rivals elbowing the ancient fixtures of the Rock and the Equitable. In the

new street in the City, bearing the name of King William, new Insurance Companies have sprung up like mushrooms, some of them perhaps not much better rooted than this species of fungus. It has been said that this noble street, with its splendid-*fronted* houses, consists chiefly of gin-palaces and insurance offices, twelve or thirteen of the latter squeezing round the two old-established companies, the London Life and Edinburgh. Again, in Waterloo-place and Regent-street, we find six or seven close to the Asylum and Palladium.

"There is a reason for this: the new ones, as we have observed, being comparatively unscrupulous in their reception of subjects, and outbidding each other in the diminution of premiums, follow up their scheme by being ready on the spot to entertain the applications of those *rejected* by the senior establishments. A person applies at some old office for an insurance on his life; the doctor finds him plethoric, asthmatic, consumptive, or dropsical; he tells him his life is not considered to be insurable: the disappointed stranger (or his agent) asks what he is to do, it being of the greatest importance he should effect an assurance. The answer probably is, 'Knock at the next door, where they are not quite so nice as we are.' Another finds the premium of the old office too high, and is unwilling to give it: he is recommended to the next door but one. The only chances, in fact, that most of the new offices have for obtaining business, lie in outbidding one another in the reduction of the premiums, and in receiving persons with bodily infirmities, or such as may be going to unhealthy climates; but they depend mostly on the reduction of the premiums. Now we contend that it is a fallacy to suppose that the reduction of a few shillings per cent. in the premium can be of any advantage to the insured, more especially where there is a participation of profits, while it operates as a serious drawback on the profits of the office, and consequently of the insured also. The higher the premium, and the stricter the caution in taking none but good lives, the larger will be the profits to be divided. It was by these means that the Equitable was enabled to amass its eleven or twelve millions, and to divide such an enormous share of profits among the insured. The Northampton Tables were generally its guide, and those insuring were not only required to produce testimonials of sound health, but in most cases to appear personally before a board of directors; and the consequence was, as the late Actuary tells us, that from the Equitable experience it was found that, where *three* persons were expected to die, *two* only actually died."

The above recited "Independent West Middlesex" Company now advertise, that their rates of insurance are "30 per cent. per annum lower than any other office." In producing this example of puffing, we do not intend to fix any especial stigma on that particular Company, but merely to justify our assertion, that there are many companies promising advantages which they cannot afford to give. There is one circumstance peculiar to institutions of this kind, which renders it absolutely necessary that the assured should ascertain that their business is conducted upon principles which are not only equitable to the assured, but also to the Company: when a life-insurance company commences operations, they have an immediate influx of capital, and their receipts may, for years, exceed their expenditure; but after twenty or thirty years have elapsed, and the "old gentleman with a scythe" has mowed down the early insurers, the system must be weighed in true scales, and if the payments received should prove inadequate to meet the increased expenditure, they will be found wanting, and ruin will await both company and assured. Professor De Morgan addresses the following considerations to any person who may intend to assure his life:—

"You are aware that the premium demanded of you is, avowedly, more than has hitherto been found sufficient for the purpose, the reason being, that it is impossible to settle the exact amount, on account of our not knowing whether the future and the past will coincide in giving the same law of mortality, and the same interest of money. The surplus arising from this overcharge, for the future existence of which it is hundreds to one, is now at your own disposal, and you must choose between one office and another, according to your intentions with regard to its ultimate destination. Firstly, if you doubt the general security of the plan of insurance, and are desirous of an absolute guarantee, independently of accumulations from premiums, there are offices which will, in consideration of the surplus aforesaid, pledge their proprietary capitals for the satisfaction of your ultimate demand upon them. Secondly, if, being of the opinion aforesaid, you think the whole surplus too much to pay for the guarantee, there are proprietary offices which retain a part of the profit in consideration of

the risk of their capital, and return the remainder. Thirdly, if you wish the surplus premium, as fast as it is proved to be such, to be applied in obviating the necessity of any further overcharges, there are offices which divide the profits during the life of the insured, by means of a reduction of premium. Fourthly, if you wish the surplus to accumulate, and, feeling confidence in your own life, are willing to risk losing it (the *surplus*, remember) entirely if you die young, on condition of having it proportionally increased if you live to be old, there are offices which divide all or most of the profits among old members. Fifthly, if you would prefer a certainty of profit, die when you may, thero are offices which at once admit new members who die early to a full participation in all advantages. The choice between these several modes must be made by yourself, according to your own inclinations, views of fairness, or particular circumstances."

COLLIER'S FILTERING MACHINE.

To the Editor of the Mechanic and Chemist.

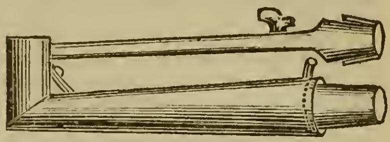
Sir,—In offering the following sketch of a machine, being a new mode of filtration, called "Collier's Aquemolus," manufactured at Blackwall, it may be observed to be a great improvement even on another of his own, complimented by the following letter from the New River Office, as a testimony of its merits:—

"New River Office, London,
August, 1835.

Sir,—Your letter of the 13th instant has been laid before the Directors of the New River Company, and I am ordered to say in answer, that the Company have no present intention of filtering the water before it is supplied to their tenants; they think, however, that your filter is very well calculated for doing this after it is delivered into the houses.

I am, Sir, &c.
(Signed) F. Inglis, Clerk.
To Mr. Collier, the inventor."

To effect the management hereof, of which directions are given in the form of a prospectus, reverse the instrument, open the tap, take off the cups and fill it completely with water, then restore the cups fast on; now remove the body containing the filtering materials in the tub or cistern, with the tube outside, which may then be let run at the tap. In a day or two the water will deliver itself quite bright. When to be cleansed, after some months, merely reversing the current by turning the tap inside, will have the desired effect in a few hours. The projecting piece at bottom, bent more or less, prevents the vibration, and keeps the cups always on their true level.



After Thames water has passed through the Aquemolus, no animalcule appears; and it may, perhaps, be considered as pure oxyhydrogen combined with carbonic acid. While health and longevity so much depend on the perfection of wholesome water taken inwardly, and for all culinary purposes, it should be presumed, that the prices being so moderate as a few shillings for lengths from 16 to 40 inches, the faculty may be justly rewarded by the original patentee for a wholesale introduction, even to their own loss, of such instruments to families and shipping, or wherever large supplies are required. C.

[It is to be regretted, as well as wondered at, that filtering is so little resorted to, notwithstanding the notorious impurity of the water with which this metropolis is supplied. If Mr. Collier should succeed in introducing his filters into general use, we do not hesitate to say that he will render a signal service to society.—Ed.]

CONSUMPTION OF OPIUM IN CHINA.

At the meeting of the Medico-Botanical Society, held on the 8th January, Dr. Sigmond observed, that he had on a former occasion described the effects upon the human frame of this fascinating indulgence; he had described from authorities of undoubted character, the progress from the commencement of the habit to the period at which premature decay destroyed the strongest constitution. The principal inducement for the Chinese to smoke opium instead of eating it, as usual among European and Asiatic nations, arose from the facility and the rapidity with which the intoxication is produced. When imbibed by the lungs into the system, it was conveyed with inconceivable quickness to every part of the body, and more especially to the brain, upon which its singular effects were most visible. The aroma of vegetable bodies, assisted by heat, actually entered into the circulation, most probably rendering the blood itself more liquid; it traversed every channel, and the minutest

capillary vessel became completely injected. It was rather as a matter of scientific inquiry, than as a political or financial question, that Dr. Sigmond had been led to examine such documents as might enable him to form an estimate of the quantity of opium consumed. He had found that calculations had been made as to the number of smokers, from the quantity that had been at various times imported from India, and from the revenue which the East India Company had derived from the sale of it. The increase from the year 1820 had been prodigious. The presumed number of smokers in three years at that period was 365,569, and they consumed about 4287 chests; these had increased in twelve years from 1822 to 1835 to 2,039,998, smokers, when about 12,339 chests were consumed; and it was now believed that the number was not les than twelve millions. The average consumption of each person was about seventeen and a half grains daily. The monopoly in Bengal supplies the government with a revenue of 961,293*l.* Amongst the papers he had seen, one stated that in 1837 the Company sold 16,916 chests, by which they gained 2,155,200 pounds sterling. Dr. Sigmond then proceeded to an inquiry into the effects of inhaling opium or the vapour of other vegetable substances on the brain, and to the mode by which they were taken into the system. He said, that it was not until the experiments of Majendie that it had been universally admitted, that vapour inhaled was absorbed with such rapidity, that it might be said to be brought into immediate contact with the heart and the brain through the circulation. It had been supposed that the impression was on the nervous system, and that smelling produced the effects: thus death had been ascribed to the odour of plants; in one instance, a daughter of the Count of Salin is said to have died from breathing the aroma of violets; in another, a daughter of the Bishop of Podolia, death took place from the odour of lilies. He then noticed the different herbs that, under certain circumstances, produce agreeable sensations when inhaled. Herodotus had spoken of flax, and in the East the seeds of hemp are commonly used, and are now likely to be substituted for opium. Although most of the narcotics produce a momentary pleasure when smoked, they all of them are injurious. Dr. Sigmond mentioned, that even stramonium, or the thorn apple, which has been largely employed as a cure for asthma, has injurious influence, and referred in proof to the death of General Gent, who introduced from India the practice of smoking stramonium for pulmonary affections. This habit had become not unusual even amongst those who were not affected with any disorder, but the circumstances attendant upon the death of the General after the use of his favourite herb, under symptoms that left no doubt as to its cause, put a check to its use.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 162.)

As we ascend in the scale of animal life, we find a nearer approach to distinct organs for the circulation. For instance, in the oyster you will perceive that there is a distinct heart perfect of its kind, which is an advance upon the dorsal vessel. And the same structure may be observed in the lobster. These organs, properly speaking, are not perfect hearts; they are termed *sinuses*, that is, dilatation of the vessel in which the vital fluid moves; but as they are evidently stronger in their structure than the other portions of the vessel, there is little doubt but that they supply the place of hearts. You will find the heart of the oyster without much trouble: it lies in the very centre of the fish. In the lobster it may easily be found, by removing carefully the large shell that covers the body, when it will be seen surrounded by the gills, or, as they are termed for some fanciful reason, "dead man's flesh."

In what are termed "cold-blooded animals," such as fishes and amphibious animals, the circulating organs approach still nearer to those of man. In these animals the blood is only imperfectly purified, by being brought into contact with the air. In fishes, which you are aware breathe by means of gills, the purification is not perfect, because the supply of air is limited. Water contains a considerable portion of air, as we might prove by placing a tumbler full under the receiver of an air-pump, and exhausting the receiver, when you would observe the bubbles of air rise from the water very rapidly, but still the quantity is limited; and although, therefore, all the blood of the fish is brought into contact with the water, so that it may absorb as much of the air contained in the latter as possible, yet it is not more purified than that of the frog, only *half* of whose blood comes into contact with the air. There is this difference to be remarked, however, that while the fish breathes air, through the medium of water, the frog breathes it direct. Although,

therefore, only half the blood contained in the body of the latter animal is sent to its lungs, while the whole of that of the fish is sent to its gills, which perform a similar office, they are both in the same situation with respect to the purification of the vital fluid; for what the fish has in quantity, the frog has in quality. The fish is compensated for not having the air direct, by having a greater quantity of its blood exposed to the action of the air contained in the water; and the frog is compensated for not having the whole of the vital fluid sent to its lungs, by having a supply of pure air direct from the great bulk of the atmosphere.

We perceive, therefore, how gradually the circulating organs become more complex as we ascend in the scale of being; how from being at first a mere pulsating tube, we find in a class of animals a little higher a distinct form of heart, and how this gradually becomes more complex, or, I should rather say, more perfect and beautiful, according to the class of animals in which we find it, until we come at last to man himself, in whom every thing is contrived in the most exquisite manner, to accomplish the object for which it is intended. We will now, therefore, take into consideration the structure and use of the organs by which the circulation is effected in ourselves; and as we proceed, I will take the opportunity of showing you more distinctly their superior perfection over those of every other class of animals.

The organs of the circulation in man have two objects to perform: first, to cause the blood to circulate through the lungs, in order that it may be purified, as I have just mentioned; and, secondly, to cause it to circulate through the body, for the purpose of supplying the various organs with their requisite degree of nourishment. To effect these objects, it is necessary, first, that there should be an organ capable of forcing the blood in the direction required—this is the heart; and, secondly, a system of vessels to convey the fluid from and back again to that organ—these are the arteries and veins.

The heart is a strong muscular body, consisting of four distinct chambers, two of which, called the right and left *auricles*, act as *receivers* of the blood,—one receiving it from the body, and the other from the lungs; and the other two chambers, called the right and left *ventricles*, act as a kind of *forcing pumps*, to send the blood out from the heart, the right ventricle sending it to the lungs, and the left forcing it over the whole body. The use of these parts may be understood from the following description:—First, the blood is received from all parts of the body in two great veins, which, uniting together, form the *right auricle*. When this becomes full, it contracts, or shortens itself in every direction, so that its contents are forced into the chamber immediately below it, on the right-hand side, called from this circumstance the *right ventricle*. You might at first suppose, that as much blood would pass back again into the veins when the auricle contracted, as into the ventricle; but this is prevented by a very beautiful contrivance of *valves*, which are so situated, that while they allow the blood to pass *into* the auricle from the veins, they will not permit it to pass back. Of these valves, however, I shall have to speak more hereafter; and, therefore, I will not allude more particularly to them just now, except to mention, that they are placed at the entrance of all the chambers, and that their office in each case is the same, namely, to permit the blood to pass in, but prevent its returning. When, therefore, the right ventricle contracts, it forces its contents onwards through a vessel which divides into two branches, one going to each of the lungs, and subsequently dividing into innumerable ramifications. The use of the right ventricle, therefore, is to force the blood into the lungs, in order that it may come into contact with the air and be purified; for I should mention, that the blood in its passage through the body loses its vital energy, and becomes contaminated. It is necessary, therefore, before it is again sent out to the different organs, that its vitality should be renewed; and this is effected by its contact with the air in the lungs. When I have to describe the process of respiration, you will understand better the part of the subject I am now alluding to, but at present, what I have stated will be sufficient for you to comprehend the reason why it is necessary the right ventricle should send the blood to the lungs. When the chemical change which takes place there has been perfected, the blood returns through the pulmonary veins to the *left auricle*,—a similar chamber to the right auricle, only situated on the left side of the heart; and when it is full, it contracts in a similar manner, forcing the blood into the *left ventricle* immediately below it. This is the strongest chamber of the heart; its fleshy walls are remarkably thick and strong, and its power is very great. This is necessary, because it is this ventricle which forces the blood to every part of the body; and it is easy to imagine, that it requires a

powerful force to impel the vital stream to the remotest parts of the system. This, then, is a description of the various parts of the heart and their uses. First, the right auricle receives the blood from all parts of the body; secondly, it passes it into the right ventricle; thirdly, this contracts and forces it over the surface of the lungs, where it is purified; fourthly, it returns by the pulmonary veins to the left auricle; fifthly, this contracting sends it into the left ventricle; and, sixthly, this in its turn contracts, and forces the blood over the whole body, to supply every organ and every part with nourishment and life. Nothing can be more beautiful than the regularity with which all these actions are performed—each part fulfilling its office with a precision that it will be in vain to look for in any machinery of human contrivance; and when we reflect that it is on this regularity and precision that our health and happiness entirely depend, we cannot fail to experience the highest degree of admiration and reverence for that great and benevolent First Cause, which has so ordered all things together for our enjoyment. "The wisdom of the Creator is in nothing seen more gloriously than in the heart! and how well does it execute its office!" says Paley. "An anatomist who understood the structure of the heart, might say beforehand that it would play; but he would expect, I think, from the complexity of its mechanism, and the delicacy of many of its parts, that it should always be liable to derangement, or that it would soon work itself out. Yet shall this wonderful machine go, night and day, for eighty years together, at the rate of a hundred thousand strokes every twenty-four hours, having at every stroke a great resistance to overcome; and shall continue this action for this length of time, without disorder and without weariness." What study to which you could direct your attention, would furnish you with any example like this of the power, wisdom, and benevolence of the Creator?

The situation of the heart is not so well understood as persons generally suppose. Most persons imagine that it lies entirely on the left side, in consequence of the palpitation being felt most strongly there; but, in fact, it lies nearly in the centre of the chest, with its apex directed against the left ribs; and it is this part beating against the ribs, which has led to the common opinion of the heart being entirely on the left side.

The heart has a more complex appearance than it would otherwise present, if its four chambers were not united together. As far as its principle of action is concerned, these chambers might have been entirely distinct, one being in one part of the body, and another in another part, provided there were proper vessels connecting them together. But there is a great advantage from the union in regard to strength, and accordingly they are found united. In some animals, however, they are found separated to a certain extent, probably in consequence of some greater advantage being derived from their separation. I have seen, for instance, in the Museum of the College of Surgeons, the heart of a dugong, which is divided into two distinct portions, attached together only at the upper part.

The muscular structure of the heart requires a few words in explanation before I pass from this part of the subject. The four cavities are formed by the union, or rather interlacing of an innumerable number of muscular fibres, which are so interwoven with each other, that they acquire great additional strength in consequence; and one part is thus to a certain extent made subservient to another. In order for you to understand clearly the manner in which these muscular fibres act, it may be necessary to mention, that it is the property of muscle, or, as it is commonly termed, flesh, to shorten fibres when stimulated. All muscle is composed of a number of fibres, which may easily be seen in meat when it is overcooked; and when these fibres are stimulated, they shorten themselves, so as to bring any two points to which they may be attached, closer together. All the motions of the body depend on the action of the muscles, and of course the heart forms no exception. The muscular fibres of this organ are stronger and more dense than in any other part of the body, and they have all of them an oblique direction, some being spiral, and others almost circular. When they are stimulated to action, they consequently squeeze the auricles and ventricles, and by this means empty them of their contents. The irritability of the muscles of the heart, or their disposition to shorten themselves when stimulated, is very extraordinary, and it is even stronger in some of the lower animals than in man. John Bell says, they are chiefly the amphibious animals, as they are called, needing little air, which have this power of retaining life; no stimuli seems to exhaust them; there seems especially to be no end to the action of the heart. A newt's or a toad's heart beats for days after the creature dies. A frog, in performing experiments, is often neglected, its limbs mangled, and its head

gone,—perhaps its spinal marrow cut across; and yet for a whole night and a day its heart will not cease beating. It seems as if nothing but loss of organization could make this irritable muscle cease to act. Thus in human beings, it is long after apparent drowning, or other suffocation, before the principle of life is gone; and long after the death of the body, before the heart be dead. In fact, the heart is the part first to live and last to die.

The external appearance of this important organ must be so well known to all of you, that it is unnecessary I should describe it; the interior, however, requires a different notice. Each of the four cavities is lined with a very delicate and exquisitely sensible membrane, on the stimulus of which depends the action of the muscles. For a long time after death, if this membrane be excited by the contact of any foreign substance, it will cause the heart to contract with great force. Some physiologists have pricked it slightly with a needle, and this caused the muscular fibres to contract so violently, as completely to bury the needle in their substance. Its natural stimulus, however, is the blood; and whensoever, therefore, either of the chambers become filled with it, they are stimulated to contract almost as powerfully as by the prick of a needle, and by this means squeeze the vital fluid out of them as before mentioned.

I cannot conclude this part of the subject, without drawing your attention most particularly to the wonderful fact I have just mentioned. *The blood itself is the stimulus which causes the heart to contract*, and, in point of fact, the blood is the immediate cause of its own action! In no other department of science can I direct you to any fact so wonderful as this. In the revolution of the planets, the constant return of the seasons, the regular succession of day and night—in all these we have astounding instances of the magnificent power of the great Creator of all; but to my mind there is something even yet more wonderful than these, in the means by which the blood creates for itself a power by which it shall be put in action. When we reflect on the innumerable list of casualties and evils "which flesh is heir to," and consider by how many thousand accidents the action of the heart,—the prime mover and regulator of that wonderful piece of mechanism the human body,—might have been brought to a sudden pause, did it depend on any contrivances independent of itself, we cannot, I think, fail to be struck with the deepest wonder and astonishment at the mode in which any contingency of the kind has been provided against, and which, by making the blood the cause of its own circulation, has given us as strong an assurance, as by "that miracle of beauty," the rainbow in the heavens, that, during summer and winter, spring time and harvest, our happiness and enjoyment are secured so far as is compatible with the existing laws of nature. Surely no one will say after this, that a subject capable of directing your minds to the consideration of such topics as these, is unfit for the attention of ladies; on the contrary, I trust, as far as you are concerned at least, that a very different opinion will be formed; and I sincerely hope that nothing during the course of this lecture has escaped from me, that could in any way offend even the most refined taste, as I assure you that it is only in the mode of treating the subject, and not in the subject itself, that any cause for censure can be found.

In my next lecture I shall conclude the description of the organs of the circulation, and endeavour to explain a few of the phenomena connected with their action.

REVIEW.

The Practical Chemist's Pocket Guide; being an Easy Introduction to the Study of Chemistry. By WILLIAM HOPE, M. D., Operative Chemist. Glasgow: W. R. M'Phun.

In this little volume, much valuable information is condensed into a small space; the author says his object was "to make a useful book of it," and this he certainly has done. The following extract will not only serve to recommend the work, but will be found interesting to many of our readers:—

"*Carbonic Acid.*—Carbonic acid was discovered by the late Dr. Black, of Edinburgh, in 1757, under the name of *fixed air*, which is still a familiar name. It was the first gas that was discovered.

It exists in a great variety of substances. All that class of salts called carbonates contain it, and it is generally from them that we obtain it for experiments. Thus marble—which is a carbonate of lime—yields it in abundance by the addition of some stronger acid, which will unite the lime and expel the carbonic acid.

Exp. The most convenient vessel for preparing this gas, is the one described for preparing hydrogen. Having put into the bottle a quantity of marble, in small lumps, pour muriatic acid, diluted with three

times its weight in water, into the funnel; it will come in contact with the carbonate of lime, and, uniting with it, will expel the carbonic acid, which may be collected in glass receivers over water. It may also be prepared by uniting the ingredients directly as in the experiment for burning charcoal in oxygen, where the product is carbonic acid.

Carbonic acid is a colourless gas at the ordinary temperature and pressure of the atmosphere; and is generally described as inodorous, though its presence can easily be ascertained from its smell alone. It is heavier than air; so that it may be collected in jars, turned upwards, by leading the tube to the bottom of the jar, and may be poured from one vessel to another, like water.

It will not support respiration. A small animal, such as a mouse, confined in the gas, immediately perishes. An atmosphere containing only one-fifth or one-sixth part of carbonic acid, will scarcely support the combustion of a candle; and it is always unsafe to venture into any place where a candle will not burn.

Obs. 1. Cases of death, from exposure to this gas, have been so frequent, that no opportunity should be lost in enforcing upon the mind of the public the necessity of caution upon this subject. Charcoal, from its cleanliness with regard to smoke, and from the freeness of its combustion, is the material most generally used where such accidents have occurred. Though the products of the combustion of anthracite and bituminous coal are the same as those from the combustion of charcoal, yet the draught required in the former case is so great as to carry away all the noxious gases in the chimney. The mischief has generally been done in small rooms, not supplied with a chimney, or any other means of ventilation. In these apartments a small portable furnace, or a chafing-dish of lighted charcoal, is placed, and the door is generally closed to preserve the temperature of the room. The first effect of the gas is slight headach, accompanied with giddiness, and almost immediately followed by insensibility; and, unless assistance be immediately afforded, death soon ensues.

2. Another source of danger from carbonic acid is, where anthracite is burned in a close stove supplied with a damper that fits closely, and when the fuel is well lighted, and in a state of glowing combustion, the damper is closed, and the gaseous products of the combustion are in consequence forced into the apartment.

Carbonic acid is always present in the atmosphere; even in the highest regions penetrated by man, it is found in about the same proportion as on the surface of the earth, viz., to the amount of about one-fifteen-hundredth part of the bulk.

Exp. Its presence may be proved by exposing lime-water to the air, in an open vessel; the carbonic acid in the atmosphere will unite with the lime, and a thin pellicle of carbonate of lime will cover its surface. From twelve to twenty-four hours is a sufficient time to make the experiment. Lime-water is one of the most delicate tests of the presence of carbonic acid; that formed in respiration is easily shown, by forcing the air from the lungs by means of a tube through this liquid.

The sources of the carbonic acid in the atmosphere have been mentioned above. It is frequently found in low situations, such as mines, old wells, caverns, &c., where it is erroneously supposed to accumulate by separation from the air, in consequence of its great weight.

Obs. From the facts that it is found in the highest regions of the air, and also, when effectually removed from old wells, will in a few days or weeks accumulate, we seem justified in the conclusion, that the carbonic acid found in low situations is liberated near the spot where it is found.

It might naturally be supposed, that from the many sources of carbonic acid, its proportion in the air would increase; but the fact is otherwise. It remains the same. The growth of vegetables—which is the only known process for taking up carbonic acid from the atmosphere—regulates the relative proportion, keeping it always the same.

Obs. The process of vegetation in relation to respiration and combustion, is a remarkable instance of the evidence of design. In this process, the carbonic acid of the air is taken up by the vegetable, the carbon is deposited, forming a part of its substance, while the oxygen is given out to keep up a supply for the processes of respiration and combustion. Thus the chief food of plants and vegetables is that which is absolutely poisonous to animals, and destructive to combustion; while that which is rejected as useless to plants, is the only nourishment for respiration and combustion.

Carbonic acid is absorbed by water, which takes up its own bulk of the gas, at the ordinary temperature and pressure of the atmosphere; but it will take up much more, if the pressure be increased. The quantity absorbed is precisely as the

pressure; that is, water dissolves twice its volume when the pressure is doubled, and three times its volume when the pressure is tripled.

Water that has been saturated with carbonic acid, requires an agreeable and lively taste, and a sparkling appearance.

Illust. Such is the case with the soda water drawn from the fountains, where the gas has been forced in by a forcing-pump, until the water has taken up some four or six times its bulk, increasing the pressure in the same proportion. The effervescence which takes place on opening a bottle of spruce-beer, cider, or brisk champagne, is owing to the escape of carbonic acid gas. Beer, porter, and ale, owe their agreeable and pungent taste, in a great measure, to the presence of this acid; and by losing it from exposure to air, they become stale.

In all cases of fermentation in malt liquors, wines, cider, yeast, &c., the changes produced are owing to the formation and escape of carbonic acid.

Carbonic acid, at ordinary temperatures, by sufficient pressure, is reduced to a transparent liquid. At the meeting of the *British Association* at Newcastle, in 1838, among the most attractive of the scientific novelties exhibited, was the solidification of carbonic acid gas, by means of apparatus invented by Robert Adams, Esq. The apparatus consists of a strong wrought-iron vessel, in appearance like a swivel-gun, two feet long, and six inches in diameter, suspended by trunnions, on an iron frame; of a vessel similar in form and size, but mounted perpendicularly on a flat stand; and of two pumps worked by powerful levers, together with the needful valves and connecting tubes. Into the generator, or suspended vessel, are put proper quantities of bicarbonate of soda and warm water; a long open tube is also inserted, containing sulphuric acid; the mouth is closed with a screw valve, and the generator being rapidly whirled round on its trunnions, the sulphuric acid flows out and is mixed with the solution of bicarbonate of soda. The carbonic acid disengaged, having no room to expand, is condensed into a liquid. So far the apparatus resembles that first employed for the same purpose by M. Thellussier in Paris. But stopping short here, Thellussier could only make use of about one-third of the carbonic acid disengaged, while Mr. Adams, by pumping it into the second vessel, obtains nearly the whole. On allowing this liquid carbonic acid to escape through a box, or hollow brass cylinder, into the atmosphere, the instantaneous evaporation of one portion causes it to absorb so much caloric as to solidify the remainder. The solid carbonic acid resembles, in appearance and texture, newly-fallen snow, or small hail; it evaporates rapidly, but not instantly; from the atmosphere of gas around it, preventing close contact, its intense coldness is not immediately felt, but the brass box in which it is collected, or the solid acid itself when long held, blisters the skin like a hot iron. By placing a portion of the solid acid on a few pounds of mercury, moistened with ether to improve the conduction, the mercury soon becomes solid, and thus the freezing of mercury—an experiment which many chemists have never seen—is performed rapidly on a large scale, and with the greatest ease and certainty. Several curious experiments were shown by means of the frozen mercury; it was doubled up and placed in water, which instantly froze, while the mercury returned to its ordinary state of fluid. But the most remarkable occurred accidentally: on touching a mass of cold iron, the mercury fused, and ran down from so good a conductor, like lead or tin in a furnace. Professor Graham did not speak too strongly when he said that such an apparatus would become as needful in the laboratory for the production of cold, as a furnace for producing heat. But the circumstance of most consequence in relation to its practical employment is, that at a temperature of 150 degrees the liquid acid exerts an expansive force of 70 atmospheres, or 1050 pounds on the square inch; and every increase of a single degree of temperature augments the pressure by upwards of an atmosphere, or 15 pounds on the inch. The iron cylinders are proved before being used, by a pressure of 150 atmospheres, and Mr. West states, that remembering the enormous power obtained, and observing the perfect ease and apparent safety with which this force is managed, he, contrary to his previous views, no longer considers the use of liquid carbonic acid, as a moving power, to be at all chimerical. Should it be so applied with success, our present locomotives would be discarded, stoppages for water would be needless, and on long lines of railway, or for long voyages, steam would be superseded by carbonic acid."

Selenium.—This is an elementary substance, of the colour of black lead, and about four times heavier than water, tasteless and inodorous. It was discovered by Professor Berzelius, of Stockholm, in 1818, in combination with an ore of iron, found in the mines of Fahlun, in Sweden.

THE CHEMIST.

NEW METHOD OF PROCURING CHLORINE.

To the Editor of the Mechanic and Chemist.

Sir,—A new fact often leads to great improvements; and being always willing to communicate (through the medium of your widely-circulated magazine) any improvement in science or art, I shall consider my time not altogether lost in describing to you a new method of making chlorine, which I have practised for the last two years, and which I can strongly recommend to the chemical part of your correspondents. It consists in pouring six equivalents of muriatic acid upon one of chloride of potass; the reaction which takes place is exemplified by the following diagram:—

1 Chlorate of Potass......	5 Chloric acid	1 Chlorine	1 Chloride of Potassium.
		5 Oxygen	
	1 Potass	1 Potassium	
		1 Oxygen	
6 Muriatic acid	6 Hydrogen		6 Water
	6 Chlorine		Liberated

By this diagram, you will see that 1 equivalent of chlorate of potass is a compound of 5 equivalents of chloric acid, and 1 of potass—chloric acid being composed of 1 chlorine and 5 oxygen; and potass, 1 potassium and oxygen; this combines with six equivalents of muriatic acid, a compound of 6 hydrogen and 6 chlorine. The 1 equivalent of chlorine in the chloric acid, combines with the 1 equivalent of potassium in the potass, and forms 1 equivalent of chloride of potassium; the 5 of oxygen in the chloric acid, and the 1 in the potass, combine with the 6 of hydrogen in the muriatic acid, and form 6 of water; the six equivalents of chlorine in the muriatic acid being set at liberty. By this means we have all the chlorine contained in the muriatic acid at our disposal' which is more than can be produced by any other process.

Chlorate of potass is a very expensive salt; but then the quantity required is so small in comparison to the gas produced, that the expense will be found to be very little more. Under ordinary circumstances it requires no heat; but if we want to produce it rapidly, a moderate heat may be applied at the commencement. Great care must be taken to add full 6 equivalents of muriatic acid, protoxide of chlorine being produced if we have less.

Felix Weiss.

Liverpool.

ARITHMETICAL QUESTIONS.

To the Editor of the Mechanic and Chemist.

Sir,—You will oblige me by inserting the following, if suitable:—

Taking 8.878 as the specific gravity of copper, $\frac{27.7274}{8.878}$ = the number of cubic inches in a lb. of copper, the reciprocal of which $\frac{8.878}{27.7274} = .32$ for a multiplier. So $\frac{7.248}{27.7274} = .26$ ditto for iron; and so for all other bodies.

Also, $\frac{1}{27.7274} = .036$ ditto for water.

Then $.5236 \times 8^3 \times .32 = 85.7866$ weight of the solid globe of copper.
$.2618 \times 8^3 \times .036 = 4.8254$ ditto of hemisphere of water.

80.9612 ditto of globe of copper equal to the internal cavity.

Then $\frac{80.9612}{.5236 \times .32} = 483 +$ and $\sqrt[3]{483} =$, &c. &c.

I have worked out the question, in compliance with "Sherwood's" suggestion, but do not think he will find it shorter or simpler. It is the usual method for converting division into multiplication. In giving artificial numbers, the method of ob-

taining them should always be shown, otherwise they will not be understood, except by the mathematician, who, of course, can construct them for himself. I would also beg to be allowed to express my opinion on the subject of multiplying pounds by shillings, &c. The very nature of multiplication, which is simply a compendious way of addition, precludes the possibility of such operations. What idea can a person attach to 5 shillings times 3 pounds; or 8 lions times 9 elephants? As to duodecimals, every one who knows anything of arithmetic, must be well aware that the method used is but a conventional way of obtaining different fractions of the multiplicand. With respect to the querist wishing to know the method by which pounds, shillings, and pence *could* be multiplied by pounds, shillings, and pence, as stated by "O. P.", it may readily be conceded that such was his desire; but then the thing *cannot be done*, and this we maintain in defiance of Cocker and Wyngate, and the world besides, if necessary. No authority can justify absurdity. A rectangular piece of board may measure 6 feet by 3 feet 4 inches, and we may wish to ascertain the superficial content: we accordingly multiply 6 feet by $3\frac{1}{3}$, or duodecimally by 3 and $\frac{4}{12}$; but the $3\frac{1}{3}$ becomes an abstract number, and the feet have nothing further to do with it than determining whether it be an integer or a fraction. If the length be taken in feet, it is an integer; if 2 yards be regarded as the length, it becomes a fraction $\frac{3\frac{1}{3}}{3}$ or $\frac{10}{9}$. In the former instance, 6 feet $\times\ 3\frac{1}{3} = 20$ feet, and in the latter 2 yards $\times\ \frac{10}{9} = 2\frac{2}{9}$ yards.

I remain yours, &c.

W. W.

[We most cordially agree with our talented and esteemed correspondent, and maintain our position with him "against the world, if necessary." An anecdote is related of Dr. Johnson, who being once at a tea party, at which Mrs. Thrale presided, that lady, in the earnestness of her argument, forgot to put the tea into the pot, and was filling the cups with clear water; the Doctor observing this, said, "Madam, you think you are making tea, but you are making water." Such is the case with those who think they are multiplying pounds by shillings, when in reality they are multiplying pounds by twentieths of a pound; a distinction which some may not comprehend, but such we should pronounce unfit for mathematical pursuits, and, *à fortiori*, for mathematical controversy.—Ed.]

MISCELLANEA.

MAKING COFFEE, BY DR. RATIER.

Take four ounces of good coffee, properly roasted and ground. Dilute it in two glasses of cold water, with a spoon. Let it steep all night, covering the vessel which contains it. Next day pour this pap with care on fine linen placed in a glass funnel in a bottle. You have an extremely strong effusion, of which a single spoonful, poured in a cup of boiling milk, is sufficient to give the whole a delightful perfume. One part of this infusion and two parts of water, put on the fire until it just boils, gives a water coffee of superb colour and perfect taste. It may indeed be conceived, that coffee, treated cold, may not have parted with every portion of its aromatic principle. Now, can cold water draw from coffee all that can be obtained from it? I answer yes! approved by experience. Indeed I have tried the process related above with boiling and with cold water, and I have assured myself by comparison, that the powder drained by the cold water, and treated then with boiling water, gave nothing but a water slightly tinted with yellow, and devoid of odour and flavour. It is besides proper to pass an equal quantity of water to the first, over the grounds, in order that the second water may serve for new powder. There is thus both economy of fuel and time, since the operation is done at once, and constantly succeeds if done in this manner. This process is not spoilt in the boiling, nor can it frequently overflow, as in the apparatus called Marize, and others which answer the purpose well, but are expensive to purchase, and require repairs. As for myself, two small decanters of glass, and a funnel of the same material, compose all my apparatus. One of the decanters contains the prepared coffee, and has a ground stopper. The other, in which the funnel is placed, receives the second water, and in its turn contains the coffee, and thus both are used in succession: all the care required is in passing a little water through them at times. Every person who has tasted my coffee, whether made with water or milk, has found it of a superior quality. I am astonished that so simple a process has not been adopted. For the coffee-houses it would have the great advantage of always having coffee ready made, not by adding water to the milk, which contains enough already, or making the coffee from the hand to mouth, but in a manner which none of the qualities sought for by true amateurs are lost. I may here mention, that the process was suggested to me in reading a memoir of M. Boullay, apothecary at Paris, upon the preparation of tinctures and extracts by a method which he calls "deplacement."—*Quarterly Journal of Agriculture.*

Potash.—This substance is known by the names of potassa and kali, but is mostly called vegetable alkali. It is obtained from vegetable substances in various ways. Pearlash, which is impure potassa, is made by evaporating the lix-

ivium of the ashes of plants, and afterwards calcining what remains. Wine lees yield much potash by combustion: this kind is the purest. Saltpetre, fused on charcoal, throws off nitric acid, and leaves alkali, which, when pure, turns itself into a liquid, very foolishly called oil of tartar. Salt of tartar is obtained by repeated combustions and evaporations of vegetable alkali. The saline products of 250lbs. of ashes of various vegetables are as follow:—

Elm	41 lbs.	6 oz.
Box	19	8
Wormwood	187	
Oak	27	12
Fir	33	
Heaths	28	12
Aspen	12	12
Fumitory	90	
Beech	54	12

The ounces in the above table must not be looked upon as quite accurate. Lixivium, which has been referred to, is the liquor in which saline substances are dissolved. WM. V——E.

Advantages of the Mulberry in Maritime Situations.—It has long been matter of regret to the admirers of maritime situations, that the baneful effects of the sea atmosphere upon almost every species of shrub and tree, has caused a particular nakedness and desolation in sea-coast views. The sycamore, hardy as it is acknowledged to be, succeeds but in part: it never assumes that rich and green flakey foliage, which constitute its peculiar beauty. Even the oak, that stately ornament of more sheltered spots, absolutely refuses to grace these dreary scenes; and the elm, tall and branching in other situations, here shrinks from the blast, and dwindles into insignificance. There is, however, one tree capable of resisting the malign influences of a sea atmosphere, and that is the mulberry: indeed, it not only defies the enemy, but even delights in its exposed situation, throwing out its able limbs in all directions and assuming a foliage rich, full, and tufted to its topmast boughs. These trees are almost abundantly prolific, and in all seasons the fruit arrives at perfection. It is therefore most singular, that the cultivation of this beautiful and useful tree, should have become so much neglected, particularly as it would thus flourish in a situation where all other trees fail, and enliven, by its noble appearance, the barren monotonous scene exhibited on our sea beaches.

Insect Ingenuity.—Insects inherit, in common with the superior animals, a degree of instinct that seems more extraordinary when displayed by creatures apparently so insignificant, and so ill qualified for the exertion of that faculty. Their usefulness to mankind, although, perhaps, not generally noticed or appreciated, is far from being contemptible; and the instinctive forethought which they possess, when exerted for the welfare of their progeny, seems almost miraculous. The nut-weevil, when prepared to deposit her eggs, selects the green hazel-nut when its shell is soft and easily penetrated; this she pierces with her proboscis, and drops her egg into the nut through this perforation; this she continues to do, selecting a separate nut for each of her eggs, until her stock is exhausted. The nut not being materially injured, continues to grow, and when the egg is hatched, the maggot which is produced from it finds its food ready ripened for its use. When the mature nut falls to the ground, the insect crawls out by a hole which it gnaws in the side of the nut, and ultimately assumes the form of a winged insect of the beetle kind. The spirex, or ichneumon wasp, pursues an almost similar course: it deposits its egg in a hole which it bores in the sand; it then seeks out a small green caterpillar, which is found on the leaves of cabbage plants, which it slightly punctures with its sting, but so slightly as not to destroy life; it then rolls it up in a circle, and places it in the sand immediately over its egg, and continues this course until it has placed twelve caterpillars, one over the other, in the nest. It repeats this process over all its eggs; it then covers up the holes and dies. The maggot hatched from the egg feeds successively on the twelve caterpillars, and by the time it has finished the last, it is fitted for the state of a chrysalis, into which it is converted, and ultimately becomes a winged insect. ALPHA.

Electricity.—M. Rousseau proposes to ascertain the purity of certain substances, and to detect any adulterations in them, by measuring their conducting power for electricity. Some years ago he described a simple apparatus, by means of which the purity of olive oil might be tested on similar principles. He now states, that by these means any adulterations in chocolate or coffee may be readily detected: he finds that pure chocolate is a non-conductor or insulator of electricity, but that in proportion to the quantity of farina or fecular matter with which it is adulterated, the more easily does it conduct electricity; and in the same way he states that coffee is an insulator, whilst chicory, with which it is often mixed, is an excellent conductor, and hence the presence of only a small quantity of that substance is easily detected in coffee by its increased conducting power. M. Rousseau also considers, that this test may be applied with advantage to the examination of pharmaceutical extracts and preparations, because they very much differ in conducting power, and therefore any mixture or adulteration will be readily discovered.—*Athenæum.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street.—Thursday, Jan. 30, Edward W. Elton, Esq., on the Genius and Influence of Shakspeare. At half-past eight.

Poplar Institution, East India-road.—Tuesday, Jan. 28, J. Mitchell, Esq., LL. D., on the History of Turkey. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney-road.—Tuesday, Jan. 28, Quarterly Meeting of the Members. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross-street.—Monday, Jan. 27, J. T. Strange, Esq., on Magnetism and Electro-Magnetism. At half-past eight precisely.

QUERIES.

SIR,—As I believe one object of your journal is to afford cheap communication between the mechanics of this country, I hope you will allow me to ask some of your very intelligent correspondents the following questions; namely,—Is there any treatise on logarithms whose natural numbers go beyond 10,000, and also its price? Can they recommend me to a good treatise on cotton-spinning, and also its price? A good treatise on mechanics; also its price? How can I calculate the power of a steam-engine; and what proportion should the boiler bear to the diameter of the cylinder? I wish also to ask some of your mathematical correspondents the following questions, namely,—Allowing the clock fingers to be together at 12 o'clock, how soon will the fingers be the legs of a right-angled triangle? There are three wheels, whose numbers of teeth are 16, 112, 14, respectively; the 16 wheel turns the 112, and the 112 turns the 14; I want to know how many revolutions each will make before they come to the same point whence they started? OPERATIVE.

[When the minute hand arrives at 3, the hour hand has advanced $\frac{1}{12}$ of the quadrant; the minute hand must, therefore, advance $\frac{1}{12}$ of the quadrant beyond the 3; but during this last process, the hour hand has again advanced $\frac{1}{12}$ of $\frac{1}{12}$ or $\frac{1}{144}$, and so on without end, forming a series (the whole quadrant being the integer), $1 + \frac{1}{12} + \frac{1}{144} + \frac{1}{1728} + \frac{1}{21736}$, &c. $= 1.0909$, &c. Now if this series be carried on till the two hands are at right angles to each other, its ultimate amount is attained, and found to be $1\frac{1}{11}$. The accuracy of this result may be proved by another mode of computation, which gives the exact place without any approximative expression. When the minute hand has performed nine revolutions, the hour hand has advanced to 9, which is exactly three quadrants distant from the point of departure; therefore, commencing at the point where the two hands are together, taking the four quadratic positions, 0^0, 90^0, 180^0, and 270^0, 33 of those positions must occur during the nine revolutions of the minute hand; therefore, $\frac{36}{33}$ is the exact place of the minute hand at the first quadrature; and this, reduced to time, makes 16*m.* 21*s.* $\frac{9}{11}$. But there is another mode of calculation still more clear and easy:—The distance of the minute hand from the 3, must, by the hypothesis, be equal to the distance of the hour hand from the 12; also the time indicated by the minute hand must be equal to the time indicated by the hour-hand; and it is clear, from the construction of the clock, that the distance of the hour hand from the 12, is $\frac{1}{12}$ that of the minute hand from 12; therefore, rejecting the space the minute hand has passed beyond 3, we have the space between the hour hand and the 12, $= \frac{1}{11}$ of the perfect quadrant, which, estimated according to the hour hand's value of position, will give 16*m.* 21*s.* $\frac{9}{11}$, the exact time at which the two hands are first perpendicular to each other, which was required.

The question concerning the wheels requires no calculation, since it is evident, at the first glance, that one revolution of the wheel 112 will produce seven revolutions of the wheel 16, and 8 of the wheel 14: the answer, therefore, is 7, 1, 8.—ED.]

Where can I procure proper metal for the seraphine, not subject to corrosion or breaking, and will stand well in tune? What is the best metal for the above? If steel be used, is there any liquid composition to prevent rust that could be applied after the tongues are tuned. I have used brass (milled), but not hammer-hardened, as recommended for the accordian; also German silver, both of which would not stand in tune, and often broke during playing. I have used steel, prepared by the watch-spring makers; it stands well in tune, but liable to corrosion, and sometimes breaking. I am now constructing another; and should any of your intelligent correspondents be kind enough to give me the information solicited, it will render great service to

A SUBSCRIBER.

1. How to make hydrosulphurate of iron? 2. How to prepare hare and rabbit skins, so that the fur will not come off? 3. How to make modelling wax a flesh colour? 4. The cheapest method of bleaching coloured calicos? 5. How to erase printing ink from paper without damaging the paper? H. DINHAM.

1. In what way can I make a scale on ivory for a thermometer; that is to say, what are the tools used in making the lines and figures, so as to give them that black appearance, and the lines equal in their distances from each other? If an instrument is used, where can I purchase it? 2. What are the rules laid down in geometry for drawing a scale for thermometer, &c., on paper?

H. B. N.

How to tin small articles of iron, such as tacks, &c., in quantities, without their adhering?

W. G. B.

In what manner is the painting (if I may so call it) on Delph and China ware put on, which daily excites our admiration, both for its accuracy and beauty? JOHN TERRY.

A full account of the manufacture and composition of Congreve matches?

Chelsea. A SUBSCRIBER.

What will have a sparkling effect upon a transparency by night? R. J. P.

How to prepare ink for printing on linen with type? P. Y. H. U.

The easiest and best method of dyeing silk a Prussian blue? C. D.

The diameter of the safety-valve of a steam-engine boiler given, is 3 inches, and loaded 10lbs. per inch; required the internal pressure of the boiler, when the valve is raised (by the internal pressure) 1-tenth, 2-tenths, 3-tenths, 4-tenths, 5-tenths, and 6-tenths of an inch? J. M. L.

The easiest and best way of ascertaining the component parts of manganese?

A Subscriber.

The best and easiest method of making tallow hard, something like wax? E. F. D.

What gas that is which takes fire on coming in contact with the air, and what are the articles necessary to make it? I have seen it made in a beer glass, as an imitation of the Jack o' Lanthorn or Will o' the Wisp, when the bubbles of gas, on coming to the surface, ignited. In Reid's "Rudiments of Chemistry," there is, I believe, a method of making it, but by following it I should be obliged to use a retort, &c. If there is one method more simple than another, I should feel obliged by your giving it me. Mott.

1. How to refine rosin, such as is used for violins? 2. How to make deep gold, pale gold, and silver bronze powders? 3. How to colour and varnish violins dark and yellow; also what kind of varnish is used? 4. How to make small lead piping? 5. How to temper chisels, such as are used for cutting mill-stones? 6. How to weld cast steel? 7. How to promote the growth of hair? E. Ledger.

ANSWERS TO QUERIES.

"Ireland" can call any evening after dark at 42, Upper York-street, Bryanston-square, where he can have that information my humble abilities will afford respecting manumotive carriages. I commenced one upon an improved principle; but through unforeseen circumstances I was obliged to discontinue it, not having the conveniences I had previously. I now should be glad to dispose of it. The wheels are very light, and six feet in height.

To fill Decayed Teeth.—Some time ago an inquiry was made for succedaneum for decayed teeth; I have tried tea lead, after having been doubled several times, and run through the rollers of a mill, until it is as thin as possible, to have the desired effect; likewise gum shellac made warm, and put into the hollow; but the other is the best, it requires no heat. W. U.

To make White Varnish.—Rectified spirits of wine, 2 gallons; gum sandarack, 5 lbs.; gum mastic, 1 lb; gum anime, 4 oz. Put them in a clean bottle to dissolve in a warm place, frequently shaking it till dissolved; then strain it through a lawn sieve, and it's fit for use.

H. Dinham.

In answer to "R. H.", if I understand him right, he wants a working model of a steam-engine and crushing-mill, together with a clarifying apparatus. If he will inform me the size and power required, with other necessary information, he may hear of something that will answer his purpose. Charles Coxel.

Clap Gate, Bowling-green-walk, Worcester.

TO CORRESPONDENTS.

T. M * * s.—*When tin articles become tarnished or soiled with smoke, the best method of restoring the polish, is to rub them with a piece of woollen cloth dipped in sperm oil; when the stains are entirely removed, wipe them quite dry, and polish with a piece of linen rag and whitening.*

J. B.—*The significations of Christian names which he has sent us are too incorrect for insertion:* Adelaide *does not signify a princess, but merely* of noble birth, *from the German* Adel *(noble).* Henry, *he says, is from the German, and means a rich lord; there is no such word in German; it is probably derived from the Greek* Hvopea, *which signifies bold and manly.* Margarite *he also derives from the German, though the word is clearly taken from the Latin* margarita, *a pearl.*

G. H. W. *wishes to know the most effectual and economical method of preventing the noise and vibration produced by the concussion of a sledge hammer on an anvil. The anvil is surrounded by three houses parted by a 14-inch wall, and this heavy dead jar is very annoying to the neighbours. The only means we can suggest, is to place some soft substance, such as a sack of straw, between the floor or ground and the anvil; by this means both the noise and the vibration of the adjacent buildings will be very much diminished.*

A Subscriber *will find a full description of the Daguerre process in No.* 43 *(New Series) of the "Mechanic and Chemist."*

A Correspondent *has pointed out an omission in a former No.* (32, *N. S.), in which No.* 97 *of the "Century of Inventions" is wanting, and the number* 97 *placed at the head of No.* 98. *This typographical error has been overlooked, but we now rectify it by giving the omitted invention:—*97. *"An instrument whereby an ignorant person may take anything in perspective, as justly, and more than the skilfullest can do by his eye." This is the invention alluded to in our remarks on the Daguerreotype, as having been so admirably accomplished by that magnificent discovery.*

H. W.—*Works on chemistry are now so numerous that we are at a loss to choose one in preference to the rest; but so rapid is the progress of that science, that the most recently published is likely to be the most correct. A small, but instructive volume has just been published, called "The Practical Chemist's Pocket Guide," by W. Hope, M. D., Glasgow. He will find some further account of this work in another column.*

S. K.—*The best material for razor strops is an oxide of iron, called by watch-makers "red stuff." Its degree of smoothness may be ascertained by its colour; the rough sort being almost black, and the smooth a bright red.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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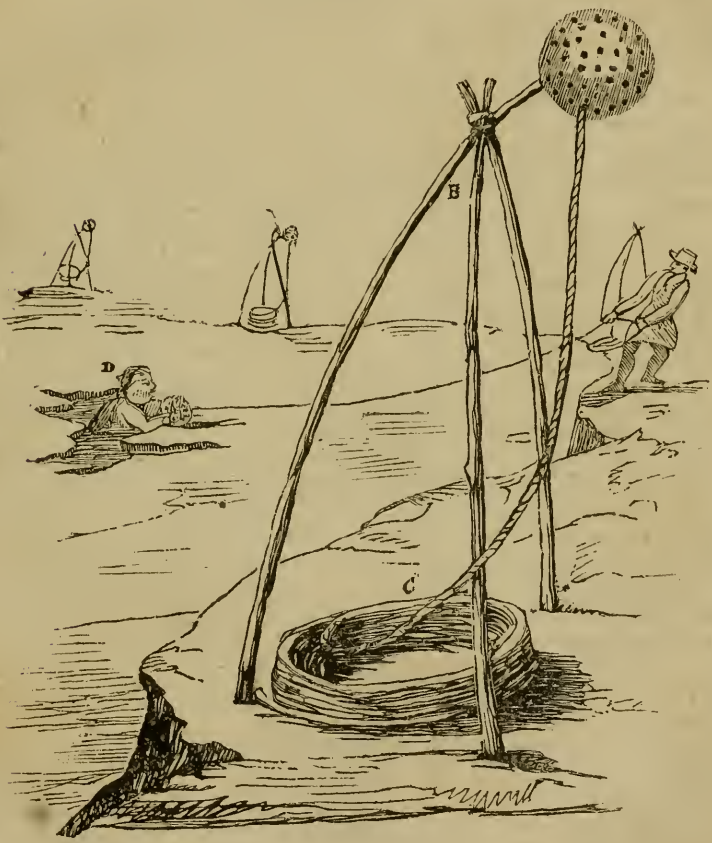
HITCHING'S APPARATUS FOR PREVENTING ACCIDENTS TO SKAITERS.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

PREVENTION OF ACCIDENTS TO SKAITERS.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Having been an eyewitness to the loss of life upon the ice from the want of *immediate* assistance, I have been led to submit the following plan for insertion in your valuable Magazine.

A, a perforated ball of deal wood from 9 to 12 inches' diameter.

B, three stakes firmly fixed in the earth.

C, a coil of rope, one end attached to the ball, and the other end fastened to one of the stakes.

D, a boy immersed.

I would suggest, that the ball should be made of deal, and perforated, so that it might be grappled by the drowning person. To render the means applicable to persons *under* water, it would be advisable to have every alternate ball loaded, for the purpose of sinking them.

The advantage of the stakes would be to protect the coil from the pressure of the crowd; and they would also serve as a beacon.

I remain yours, &c.,
C. G. Hitchings.

ON THE CIRCULATION OF THE BLOOD.

(Continued from page 175.)

In my last lecture I described generally the use of the circulation, by enumerating a few of the important objects it performs; and after giving a brief account of the organs by which the blood is circulated in the lower order of animals, I partially completed a description of the heart, and the offices it is required to fulfil. I described its situation, the number of cavities it contains, with their uses, and a few particulars relating to its muscular structure. I have now to direct your attention to a portion of mechanism connected with this organ, which has ever been a subject of admiration to the student of Nature, and a powerful evidence in the hands of the theologian, of the existence, wisdom, and benevolence of God. I allude to the valves of the heart, which I before incidentally mentioned, when describing the manner in which the blood was acted upon by the different parts of that organ. The valves are for the purpose of causing the blood to proceed in one direction, by preventing its return to any of the chambers of the heart from which it may have been expelled. They are, therefore, placed in such a position, that while they offer no impediment to the entrance of the blood into the auricle or ventricle, they effectually prevent its returning back; and they act on a principle so purely mechanical, and so easily to be understood, that any one who has taken the trouble to examine a sheep's heart, for instance, will never forget the beautiful instance it affords of the application of an admirably simple contrivance, to a purpose of permanent importance. If we cut a heart across in order to examine it, we shall find, on attempting to pass any substance upwards, that its progress will be resisted, and if a portion of the muscular part be taken off, so as to exhibit the obstruction, the valves and their use will then become evident: they will be seen to be somewhat in form like the sails of a ship, one edge being fixed to the side of the heart, and the others tied down, as it were, by little cords: the use of which I shall explain more at length presently. When the blood attempts to pass back, it gets between the sides of the heart and these valves, and bulges them out, so that they press against each other, and close the passage as completely as if a single membrane had been drawn across the opening. In the great artery which rises direct from the heart, the aorta, the valves are of a different form, though performing the same office. They are there like three little cups fixed to the side, which being very flexible, are easily pressed against the side of the vessel when the blood is passing out of the heart; but if it attempts to return, it then fills these cups, which are, consequently, pressed out, stop up the artery, and so prevent any further retrograde motion. The three cups being nearly round, there is, of course, a small opening between them, where they touch each other; and the contrivance by which this opening is closed, is another evidence of the perfection of this mechanism. Each valve, or cup, as I have called them, is furnished with a little projecting tongue, which, when the valves are distended, just fill up the opening that would otherwise be left. Nor are these the only instances of beautiful mechanism endowed with the property of life, to be found in this structure. There is something even yet more surprising; and in describing it, I cannot do better than use the words of the writer of the very excellent treatise on animal physiology in the "Library of Useful Knowledge." He says, "There is a further contrivance adopted, and one which the mind cannot contemplate without admiration, in order to render the action of

the valve placed between the auricle and ventricle perfect. Were the membrane, which is placed in this situation, loose, it is obvious that the refluent blood would carry it back into the auricle, and thus effectually prevent its action as a valve. But the fleshy columns which are placed in the inside of the ventricle, give off numerous threads, which are attached by one extremity to these fleshy columns, and by the other to the loose edge of the valve. These tendinous threads, like so many strings, tie down the valve to its proper situation; and being thus secured, the membrane is not only prevented from being carried by the impetus of the refluent blood too far into the auricle, but that any impetus is the means of giving it the distension and figure that are required. But the perfection and beauty of the mechanism do not stop even here. Each of these fleshy columns may be considered as a distinct muscle; each is endowed with the peculiar property of the muscular fibre, that of contractility; each is excited to contraction by the contact of the blood, just as the ventricle itself; each, therefore, by contraction, shortens all the tendinous threads attached to it, just at the moment that these strings require to be tightened; and they further tighten them in the precise proportion required; for the distension of the membrane by the refluent blood stretches these tendinous threads, and the stretching of the tendinous threads stretches the fleshy columns. The fleshy columns are thus still further irritated, excited, stimulated: the consequence of this excitation is proportionably increased contraction, and the ultimate result, increased security that the valve will be held in the precise position that is required, with exactly the degree of strength that is wanted. Thus there is accomplished here the construction of a valve, which is not only most perfect in itself, but which is endured with a property to which no other mechanism affords any parallel—a valve capable of generating a power that enables it to act with additional force, whenever additional force is requisite. Among the countless instances of wise and beneficent adjustment familiar to the student of nature, there is commonly some one upon which his mind rests with peculiar satisfaction; some one to which it finds itself constantly recurring, as affording the proof which cannot be resisted, of the operation of an intelligence that has foreseen and planned an end, and provided for its accomplishment by the most perfect means; and surely there is nothing more worthy to become one such resting place to the philosophic mind, than the structure and action of the valves of the heart."

If anything further could be added to this beautiful description, in confirmation of the passage with which it concludes, it would be from a consideration of what would be the effect of the valves not efficiently performing their office. They are formed of the most delicate material; so thin, that it is almost transparent; and they are tied down, as just mentioned, by tendinous threads not thicker than sewing silk. Yet with this appearance of weakness, they possess a strength that is most extraordinary. They cannot be torn from the heart without great violence, and to this circumstance we owe the daily enjoyment of life and health. Had they been liable to the derangement we might at first sight imagine they could not fail of being constantly subject to, what a life of misery would ours have been! They are sometimes attacked with a disorder, in consequence of which they lose their elasticity, and become converted into bone; and the sufferings of the unhappy patient in such cases show what the value of their regular action is in general, and how well they perform their duties for the number of years they are so actively employed.

It may naturally be supposed, that an organ of such great importance as the heart, is protected from all kind of injury as far as possible; and its situation in the breast, where the hands can be brought to protect it with the greatest ease and convenience, is an example how far this object has been accomplished externally. But in addition to this, and the protection it receives from the bones with which it is surrounded, it is carefully covered up in a case, called the heart's sac or Pericardium, which adheres to its external surface, supports it in its situation, prevents its action being interfered with by other organs, and supplies a fluid to keep its surface moist, and facilitate its motion. This fluid accumulates after death, and a grave discussion once took place among the older anatomists whether this was not the fluid which came from the side of our Saviour when it was pierced with the spear! Though this might probably be the case, it was hardly a fit subject for angry discussion. The heart's sac is very strong, and affords great support as well as protection to that organ. Though rough on the exterior, it is beautifully smooth within, so that it affords the most perfect facility of action; and considered merely with reference to the properties I have described, without referring to the vital actions it may perform, or assist in per-

forming, it is a beautiful example of the perfection of the heart's mechanism. For after everything has been done to render it perfect, it is enclosed *in a case* to protect it from injury, just in the same way as an artizan would guard any work of mechanism on which he had bestowed his best care and attention to bring to perfection.

I have thus given you a general description of the structure and use of the heart, the powerful organ by which the blood is circulated; I have now to call your attention to the vessels or tubes through which the blood is conveyed. These are of two kinds; one proceeding *from* the heart, and called *arteries*, the other coming *to* the heart, and called *veins*.

The *arteries* are the vessels which contain the purified blood, and convey it from the heart to every part of the body. They commence in one large trunk called the aorta, which rises direct from the left ventricle, and subdivides into an innumerable number of branches, and they become gradually smaller as their distance from the heart increases. The arteries are formed of three distinct coats, each of which has some property peculiar to itself. The outer coat, the case for the other two, is very tough and elastic, and gives the artery a great degree of strength, for which reason it is found to be much thicker in the larger arteries than in the small ones, as the former have to bear a pressure and force of the blood from which the smaller vessels are relieved. The second or middle coat is muscular, and it possesses the same property as the heart itself of contracting. It consists of a number of rings; or, more strictly speaking, of *half rings*, which meet, and so form circles round the artery. Having the property of contracting, this coat of the vessel greatly assists the power of the heart in moving the blood; as it is evident when the rings contract they must squeeze their contents onwards, and thus force the blood in the direction required. It is a singular fact, that this coat is found much stronger in comparison in the small arteries than in the large ones. In the former the heart's action cannot be felt so powerfully as in the main trunks of the vessels; and hence it is necessary that they should be better provided with the means of assisting the circulation. At the same time the outer coat is much thinner, because strength is not so greatly required. The third and inner coat of these vessels is evidently formed for the purpose of affording the greatest facility to the passage of the blood. It is so beautifully smooth that I am at a loss for a simile. A tube of metal, with the highest polish the interior could receive, would not offer so little resistance to the passage of a liquid: for in addition to its exquisite smoothness, the interior of the artery secrets a peculiar fluid, which serves still further to remove all possible friction, and facilitate to the utmost the motion of the blood; and this is also promoted by the action of the muscular coat.

(*To be continued.*)

LOAN SOCIETIES.

To the Editor of the Mechanic and Chemist.

Sir,—Although the following statement may not relate to a subject usually treated in your valuable work, I do consider from your wish to protect the public from imposition, you will give it a place in your columns. I have, Sir, unfortunately been induced to accept a loan from a Society called the Eagle, in Long Acre, which I consider you will find fraught with evil to the poor man, and who, I should like to know but the poor would require their aid? Now, Sir, to enter into detail, you first pay 2*d.* for a copy of rules, then 3s. (the stated average is 2*s.*) for looking after security; mine happened to be a few yards over two miles, which gave them a pretext for charging another shilling. The interest at 5 per cent, with price of book 1s. is deducted previously to the loan being placed into the hands of the borrower, which leaves a nett of 4*l.* 10*s.* 10*d.* out of 5*l.* He has then to pay by instalments 2*s.* per week and 2*d.* for booking; if missing, 1*d.* fine each week omitted, and if the second week be left, the secretary sends a circular, in which he demands 6*d.* fees, 3*d.* fines and 3*d.* for letter, amounting with postage to 1*s.* 2*d.*, which he may demand the moment the two weeks are expired. From various reasons I have been obliged to pay two weeks when three have been demanded, they have then charged the whole of the fines, and if let run on another two weeks, charged for three weeks.

Then, Sir, if a person go previous to the time for payment, which is on Wednesday evening, and have no letter sent, they charge the 3*d.* the same, and if he murmur, they say, "Oh, if you do not like that I will send as soon as the two weeks are expired. I have now reimbursed 2*l.* 8*s.* of sum lent, for which I have actually paid 17*s.* 6*d.*!!!

Your obedient Servant,

W. M'C.

P.S. That they may know who writes this, my number in their books is 779.

[The above letter was accompanied with

testimonials of the truth of the allegations it contains, and we can affirm that the writer is an honourable and respectable person; we therefore not only feel authorized to publish it, but consider it our incumbent duty to do so. We do not point out this particular society as worse than their numerous rivals, but merely take it as a fair average of the extortionate Loan Societies of London. As we have no knowledge of the parties who divide the spoils of the victims who writhe beneath the talons of this ruthless "Eagle," we trust that our sincerity will not be questioned, when we declare that in analizing the rules of this Society, we are influenced by no other motive than a desire to lead the unfortunate and the inconsiderate from so dangerous a path, and make them sensible of the ruin which lurks beneath the specious and alluring professions of heartless, usurous, and overreaching speculators. First, let us inquire what is the rate of interest per annum exacted from the borrower under the most favourable circumstances, and supposing the Society to refrain from all further extortions, which, we shall afterwards show, are indefinitely sanctioned by their printed laws. In order to obtain this "benefit," the borrower of 5*l.* must find respectable bail within two miles of Long Acre, (the centre of the Society's web), and that bail must be accepted by the Society, otherwise they will make additional charges for further inquiries; he must also punctually pay his instalments at the exact periods appointed, under the penalty of considerable and vexatious fines. Under these circumstances, the borrower must pay 2*s.* at the time of application, and in addition to that sum 5*s.* is deducted for interest, which, according to the Society's computation, is 5 per cent, and 1*s.* for a halfpenny book, leaving 4*l* 12*s.* the sum actually lent. For this accommodation, the borrower is required to pay 2*s.* 2*d.* per week for fifty weeks, making together 5*l.* 8*s.* 4*d.*, from which it appears that the money lent, is repaid within a small fraction on the forty-fifth week. But the value of the interest on each successive portion of the capital repaid by weekly instalments, forms an arithmetical series; therefore this mode of payment is equivalent to the whole being paid about the twenty-third week, or $\frac{23}{52}$ of a year, now the interest demanded for the loan of 4*l.* 12*s.* for that period, is 16*s.* 4*d.*, consequently $\frac{23}{52}$ annual interest = 16*s.* 4*d.* and annual interest = 1*l.* 16*s.* = 39 per cent. On this statement we have omitted fractions, and have mostly given the benefit of them to the vulture—we beg pardon, the "Eagle" Society. Now if we add to this amount the produce of the various casualties, snares, and impositions from which very few, or perhaps none can wholly escape, the interest will amount to about double the above already scandalous extortion. We must, however, give this Society credit for some clever contrivances which enable them to regulate their demands according to the different degrees of resistance opposed by different dupes; we will quote as an example, a beautiful passage in the fourth Article of the rules:—"Each borrower will also have to pay such further sum *as may be agreed upon between the Directors and him* towards defraying the necessary expenses of books, printing, management, and rent of office; as also for a fund for the liquidation of any losses which may be sustained by death or otherwise; part of which sums may be paid at the time the Loan is advanced, and the remainder by weekly payments with the other instalments." We conclude for the present this very unpleasant, but we trust, not useless investigation, by imploring those of our readers who may unfortunately be in want of Five Pounds, to avoid Loan Societies of this description, whatever difficulties they may encounter, or whatever privations they may endure.—Ed.]

IMPROVED METHOD OF TEACHING MUSIC.

It has often been remarked and wondered at that music should be so little understood, and so imperfectly taught, as it is in most countries, and more especially in England, notwithstanding the almost universal desire, if not to cultivate it as a science, at least to practice it as an art. We do not require the practical musician to dive into profound calculations concerning harmonics (one of the most difficult branches of the mathematics), nor do we recommend that the practical progress of the amateur student should be impeded by a premature inculcation of the principles of harmony and rhythmic erudition; but such is the incapacity of many who undertake the office of teacher, that they are not only ignorant of everything beyond mere notation and mechanical performance on some instrument, but are actually incapable of reading and understanding a piece of music without instrumental aid. About eight or ten years ago, a schoolmaster at Zurich imagined a system of teaching, which succeeded so

well, that he was induced to visit all the principal towns in Switzerland, for the purpose of explaining and establishing his plan of instruction; he was invariably received in the most flattering manner, and his system carried into operation. His lessons were confined to sacred music, and he was usually allowed the use of a church. A large black board, with five conspicuous white lines for the staves, was exhibited in a convenient place, so that everyone present might see it. On this board (which he calls *ardoise* or slate) the notes were written with chalk, and altered according to the subject of the lecture or lesson. The teacher holds a wand with a white ball at the end, and with this he points out the note to be sung, passing promiscuously from one part of the scale to another, till the pupils are able to produce the proper intonation, and sing any simple melody at sight. This is a great point gained, and should, we conceive, always be the first step in the study of practical music. Other subjects are successively treated in a similar manner, till the pupil has attained the required proficiency. This plan has since been introduced in France, and we hope to see it in operation with equal success in England. The following is extracted from a correspondent of the *Athenæum*, dated "Paris, Jan. 18."

"Without examining how far popular opinion may or may not have of late unjustly connected the merits of M. Mainzer's method of instruction with the little honour awarded to him as a composer—his opera 'La Jacquerie,' upon its recent production at the Theatre de la Renaissance, having, on account of its want of variety, been sarcastically characterized in the *feuilleton* of M. Berlioz as 'an opera in *re*' (the key of D)—it is certain, that M. Wilhem's plan has been adopted in schools of a high order, as well as among the public of the markets and boulevards—that it has been circulated over the continent, is now in England, having been recently taken thither by some professors, who intend introducing it in London. Hence it is needless for me, were I qualified, here to discuss it analytically—I am still less able to furnish a connected sketch of the whole process; but a leaf from my journal, in which is chronicled my Saturday evening's occupation, may afford some far-off idea of one of its best features—namely, its providing adequate and simultaneous interest and occupation for scholars of every degree, from the urchin, on his first evening's entrance from the *quay*, or alley, progressively upward to the well-practised monitor, so firm in scientific knowledge, that he is able not only to read, at sight, a single *solfeggio* from Steffani, Durante, and Handel, of any intricacy, but also to maintain his own part in proper style and spirit, however complicated be the whole, of which that part is only a third or a fourth.

I was present at the drilling of a class of men, of all ages, and, it seemed, of all conditions. When the moment for commencement arrived, the entire party was separated into twenty or thirty smaller companies, each numbering some fifteen or twenty individuals—each, too, under the guidance of a monitor, who referred to an exercise board in aid of his explanations. Thus arranged, they extended round the room, leaving its centre free for the superintendent, who, baton and tuning-fork in hand, presided over their exercises. Nearest the door were the new-comers, to whom their monitor was explaining the number of notes in the scale, and their names, '*Do, ré, mi*,' &c.,—availing himself, at the same time, of an ingenious *memoria technica*, which is one of the peculiar inventions of M. Wilhem's system, and in which the fingers, and the spaces between them, are employed by the neophyte to represent to himself the octave and its divisions. The next knot consisted of those who, having learned their notes, were reading *verbally*, not *vocally*, a scale-exercise, in which some of the simplest divisions of rhythm and tune were inculcated. A third group was studying the first intervals—the hand alphabet which I have mentioned being employed by all, and every pupil being compelled to read and count his exercise ere he attempt to sing it;—while a fourth party was taking in fifths, sevenths, ninths, &c.; and so on, until those were progressively reached who were firm and ready enough to attack a composition in two or more parts. It was so arranged, that while one section of the pupils was singing, others might continue their *reading* practice undisturbed; and, from a careful inspection of the whole, resulted the impression, that no element of music was overlooked, or its comprehension empirically forced upon the pupil before he was prepared for its reception. I ought to add, that the exercises commenced and closed by the whole body singing the scale together: first, the notes of the common chord—then the tones and semi-tones of the octave, ascending and descending, *pianissimo* and *fortissimo*—now detached, now bound—then in thirds—lastly, in a full harmony, of three parts. The effect of

this, from the purity, firmness, and sweetness of the tone, was very fine.

If I were musicially pleased with the results of a system so comprehensive in its operation, I was no less morally gratified by the diligence and respectable demeanour of the learners. The mature man of forty (and there were many such in the company) was not more sedulous or attentive than the *gamin* of twelve, with his longer life of a tenor or bass voice before him. There was no rude joking—no making a pretext of the presence of strangers as inquisitive as ——— and myself, for carelessness or want of application. All seemed interested, because amused, by that healthiest of all amusements, the reception of new ideas, upon a subject in itself welcome and agreeable. I must insist, moreover, that M. Wilhem's method, here carried into effect by his able pupil, M. Hubert, seems excellent, as inculcating, from the first, some principles of style as well as of science. Of this I had confirmatory proof in the exercises gone through by the monitors after their pupils were dismissed. These young men first read, and afterwards sang, *solfeggi* of great complication and difficulty, at first in single parts, then in combination; and this not merely with a mechanical firmness, which no syncopation, or protracted division, or difficult interval, or accidental sharp or flat, could shake; but with a feeling for that expression and regulation of phrase, which, when in perfection, almost as much as physical attainment, distinguishes a Thalberg or a Mendelssohn from the well-trained child, who makes impartial friends yawn with her *pianism* at holiday-tide! In short, all that I saw and heard satisfied me highly at the moment—satisfies me yet more completely on reflection."

MISCELLANEA.

To make Turpentine Varnish.—Take one gallon of spirits of turpentine, and five pounds of rosin pounded; put it into a tin can on a stove, and let it boil half an hour; when cool it is fit for use.

To make the Best White Hard Varnish.—Rectified spirits of wine, two gallons; gum sandrach, five pounds; gum mastich, one pound; gum anime, four ounces. Put these in a clean can or bottle to dissolve, in a warm place, frequently shaking it; when the gum is dissolved, strain it through a lawn sieve, and it is fit for use.

W. G. A. H.

Goldbeaters, by hammering, can reduce gold to leaves so thin, that 282,000 must be laid upon each other to produce the thickness of an inch, yet those leaves are perfect, or without holes, so that one of them laid upon any surface, as in gilding, gives the appearance of solid gold. They are so thin, that if formed into a book, 1500 would only occupy the space of a single leaf of common paper, and an octavo volume of an inch thick, would have as many pages as the books of a well-stocked library of 1500 volumes, with 400 pages each.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street.—Thursday, Feb. 6, J. C. Bowles, Esq., on Hydrostatics. At half-past eight.

Poplar Institution, East India-road.—Tuesday, Feb. 4, W. Jones, Esq., F. R. C. S., on Vital Statistics. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney-road. — Tuesday, Feb. 4, W. A. Sherwin, Esq., on Mining. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross-street. — Monday, Feb. 3, J. T. Strange, Esq., on Magnetism and Electro-Magnetism. At half-past eight precisely.

QUERIES.

What is British silver composed of, and the various portions of each substances contained therein? T. F. B.

I have in my possession an old home-mad violin, which is very dirty; I wish to clean, stain, and polish it, but know not how to proceed; if you or any of your correspondents will favour me with a method for so doing, it will much oblige A. C. R.

1. What will remove the silver from plated goods without injuring the silver? I have tried the following, but it did not answer:—To 3lb. of sulphuric acid, and $1\frac{1}{2}$oz. of nitre, add I pint of water; boil the goods in it, then put the silver into common salt, dissolved in water. 2. What is the best way to dissolve India-rubber, so that when dissolved it may be applied to render paper water-proof? 3. Is there any substance into which Congreve matches may be dipped, that will restore their igniting quality which they have lost from being kept too long? A. R. S.

1. How to make fulminating silver (giving the whole process)? 2. How the crackers which you throw down, and those you pull, are made? 3. How to make printing ink? 4. How to make good amalgum? 5. How to make a mould of plaster of Paris which last for several times? 6. Whether fulminating mercury will make as loud a report as silver? R. H. H.

1. Has any one in Brighton, or its immediate vicinity, a good electrical magazine to dispose of at a moderate price? 2. How to construct a working model of a velocipede? 3. How to imitate rock-work for models of rims, &c.? 4. The most economical method of making a galvanic battery? Also, what experiments can be performed with it? 5. The manner of making a reflector, so as to throw the reflection of a light in any direction? MELEK RIC.

I should be greatly obliged if any of your correspondents could inform me where I can purchase a book on short-hand writing cheap?

A YOUTH.

How to prepare liquid sulphuretted hydrogen?

ERASMUS THE ELDER.

1. How is the exact precision of thermometer tubes throughout their length, to be ascertained? 2. Does the bitter of coffee possess a strengthening quality? 3. What is the best means of preserving geraniums during winter? 4. How are percussion caps manufactured? 5. What are the principal causes of variation in the carrying distance of different guns? 6. Can any of your correspondents describe the air-gun? 7. What is the best substance to execute models in, similar to that of the rock of Gibraltar in the long-room at Woolwich? 8. What distance will a thirty-two pounder carry, if the ball meet with no interruption until it be quite spent?

WM. V——E.

ANSWERS TO QUERIES.

A correspondent wishes to know the cheapest means of constructing a hydro-oxygen microscope. The best way, I think, is to buy one already made, if cheapness be his object. I have one (equal to any ever made), with objects, &c., which I wish to dispose of. C. S.

5, Garden-row, High-street, Camberwell.

To prepare an Ink for Printing on Linen with Type.—" P. Y. H. U." Dissolve one part of asphaltum in four parts of oil of turpentine, and add lamp black, or black lead, in fine powder, in sufficient quantity to render the ink of proper consistence for printing with type.

ERASMUS THE ELDER.

To Varnish and Colour Violins Yellow.—Take half a gallon of rectified spirits of wine, to which put six ounces of gum sandrach, three ounces of gum mastich, and half a pint of turpentine varnish; put the above in a tin can, keep it in a very warm place, frequently shaking it, until it is dissolved; strain it and keep it for use. Should you find it harder than you wish, you may add a little more turpentine varnish. There is no need whatever to stain the wood, as a very small bit of aloes put into the varnish, will make it of a good colour, and has the desired effect.

To make Phosphuretted Hydrogen.—The easiest and cheapest way to make this gas, so that it may be experimented on, is by placing one part of phosphorus, and ten parts of strong solution of potash, in a common oil flask, with a cork in its neck, to which is attached a glass tube, properly luted, the bottom of the tube dipping into some water; bring the mixture into the flask to boil, and an abundance of this gas will be extricated, and inflame at the top of the water. But I think the following will suit your correspondent's views still better. Take a tumbler, and place in it half a part of phosphorus, cut in very small pieces; 1 part of granulated zinc; 3 parts of concentrated sulphuric acid; and 5 parts of water; sulphuretted hydrogen is obtained, and the whole resembles a well of fire. If your correspondent requires any further explanation, I shall be most happy to supply him with it. R. T.

TO CORRESPONDENTS.

An Apprentice.—*We refer him to our publisher, Mr. Berger, in Holywell-street, where he will obtain the information he requires.*

Melec Ric.—*To find the diameter of a circle seven times greater than a given circle, take the square root of seven times the square of the given circle.*

The distances, and consequently the sizes of the planets may be computed by their parallax, which is, in fact, only a particular application of trigonometry.

Various attempts have been made to improve, condense, and simplify the Elements of Euclid; but in our estimation, the original work is, beyond comparison, superior to all those which are intended to supersede it.

There is a description of a cheap air-pump in No. 47, Vol. 2, of the " Mechanic "; we think, however, that some of our correspondents might favour us with a more convenient construction.

The best cement for uniting brass-work with glass, is shellac applied by heating the parts to be joined, when the nature of the apparatus will allow it, but if not, it may be dissolved in spirit, and a small quantity of isinglass (ichtheocolla) added to make it less brittle. This composition will also serve to render wood or paper waterproof.

William V——e.—*The undulations of the air, which are the cause of sound, are usually compared to the circles formed in water when a stone is thrown into a still pond; there is, however, this material difference, that the vibrations of sound are propagated in spherical shells expanding in every direction, as the undulations of water expand horizontally. But although air is the vehicle by which the vibrations of sound are ordinarily conveyed to the ear, it must be observed that other substances possess the power of transmitting those vibrations, even with more intensity than the air, as may easily be shown by placing a watch at one end of a long piece of timber, and applying the ear to the other end, when the ticking will be distinctly audible. When a vibrating sonorous body is enclosed, as we find in a musical snuff-box, the direct series of vibrations communicated to the air by the sonorous body, do not reach the ear, there being no communication between the internal and external air; but the box itself vibrates, and the sound is accordingly found to vary in quality and intensity, with boxes composed of materials possessing different sonorous powers; also the aptness for vibration of the table on which the box is placed, very considerably affects both the intensity and the* timbre *or voice of the sounds. The vibrations of a bell placed under the receiver of an air-pump, are not audible, there being no medium of communication between the vibrating body and the substance of the machine or the receiver.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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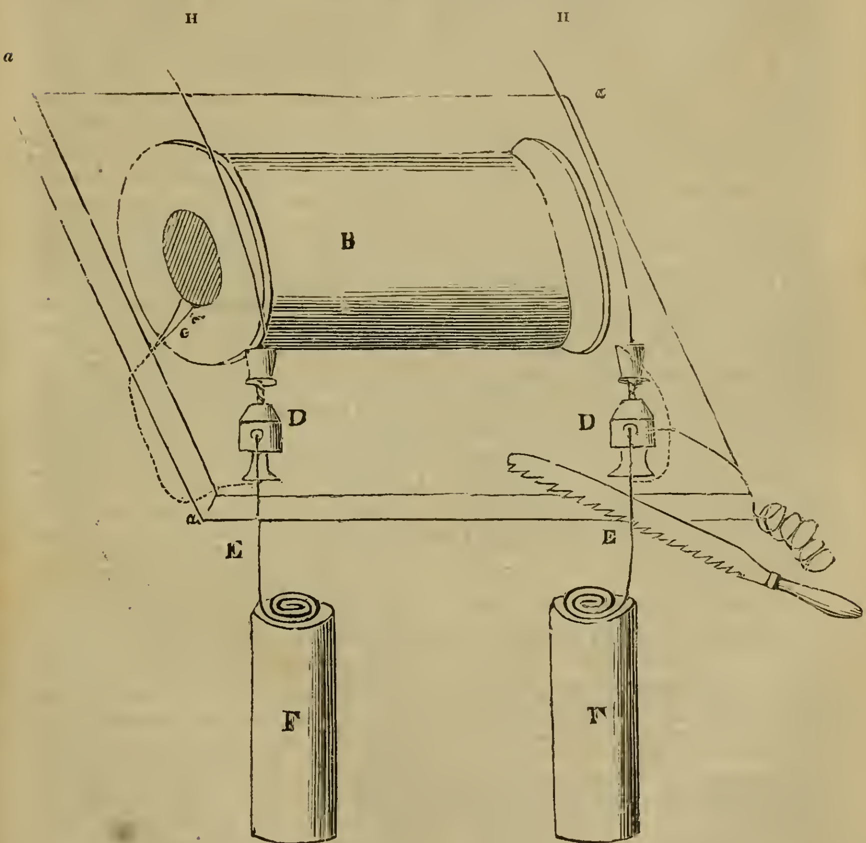
ELECTRO-MAGNETIC MACHINE.



VOL. V.—No. 26.]

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

ELECTRO-MAGNETIC MACHINE.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—" Magneticon" will perhaps find the following electro-magnetic machine answer his purpose. I have not seen any other kind, of the same size and number of batteries. more powerful.

a a a a is a square board; B is a round spawl, with a hole through it, one inch in diameter, with a flange about three inches; it is four inches long. Through the flange there is a small hole bored, to fasten it to the board, and another, *c*, through which the ends of the copper wires are placed. The copper wire which is first wound round, is about the sixteenth of an inch thick; of this wind but one thickness, and then about 700 feet of the finest wire (I believe) which is covered; both ends of these wires must then be soldered together, and brought underneath the board and soldered to the screw, by which the brass connector, D, is fastened to the board. The connector is made of brass, with a hole through the side, into which the set screw pushes, with a hollow top, to contain a small portion of mercury; through these holes are placed the copper wires, E E, to the end of which (after it has been bent into a spiral spring, so as to allow it to give way) is soldered a brass tube, F F, to take hold of; into the cups are then placed the wires, H H, from the batteries, the connectors of which are made in the same way; G is a small brass saw for breaking the connexion, instead of the revolving magnet; it is connected to the mucrid cups by a small spiral wire. The ram to be placed in the spawl is a cylinder of sheet tin, which is filled with pieces of soft iron wire.

W. E.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 186.)

The arteries are distinguished from the veins by having what is termed a pulse.* In the veins the motion of the blood is not perceptible; but in the arteries, it is felt bounding up against the sides, in the way you may perceive, by looking at the part between your thumb and finger, where you will see a small artery continually beating. If one of these vessels be cut—if it be a large vessel—the whole of the blood in the body will soon be forced through the wound, and the animal will die. Indeed a slight incision in any of the larger arteries, is sufficient to cause death from loss of blood; and in this way literally "each of us may his quietus make with a bare bodkin." The arteries are, in consequence, provided against accidents as much as possible. They do not lie so near the skin as the veins; indeed the latter, when the hand is warm, seem almost starting from the skin; but the arteries are situated deeper in the flesh. They are well protected from injuries occurring from the force of the blood by the strength of their coats; but these are not always sufficient for the purpose. They are sometimes injured by the centre coat, which, as before mentioned, is muscular, breaking and allowing the blood to distend the other coat. Whenever this occurs, a singular and terrible disease takes place, which is called aneurism. The outer coat is so strong and elastic, that it will not break like the muscular coat, which is found to be exceedingly brittle; but, unable to resist the force of the blood, it gradually becomes distended into a sac, which bulges out from the side of the artery, and which, if it bursts, allows the whole of the blood to escape. It is not necessary that I should detail to you farther particulars of this singular accident to which the arteries are subject. I need only mention, that while in former days it was considered fatal—as the means by which the accident could be remedied were unknown—it is now cured every day in our hospitals, when it occurs in arteries even but a small distance from the heart, by stopping the passage of the blood in the affected vessel, and thus preventing the blood passing the part diseased. It is found that little inconvenience is experienced from this stoppage of the artery, though we might at first suppose that mortification would ensue; but these vessels communicate by branches so freely with each other, that when one artery is stopped up, another performs its duties.†

* The following is a table of the rate at which the pulse usually beats at different periods of life, and likewise in some of the domestic animals:—

	Per Minute.
In infancy, from	130 to 140
Mature age	72 to 75
Old age	60 to 65
Horse	32 to 38
Ass	48 to 54
Ox	35 to 42
Sheep	70 to 79
Goat	72 to 76
Dog	90 to 100
Cat	110 to 120.

† In lecturing to ladies, and, indeed, to general audiences on physiology, it is desirable not to

The importance of these vessels is seen by the care with which they have been protected against external injuries. Had they been exposed, like the veins, the most trifling accident might have been fatal, whereas, by being deeply seated, they are comparatively out of danger. But this is not the only way in which they are protected: in exposed situations they have channels formed for them even in the bones. Thus, under each of the ribs there is a perfect channel in order to protect the arteries passing along them; and in the spine, the head, and many other bones, there are holes formed purposely to allow the branch of an artery to pass through without being injured by any improper degree of pressure or otherwise. Paley expressly alludes to the care which has been bestowed on the protection of the arteries, as an instance of divine Providence. "Forasmuch," he says, "as in the arteries, by reason of the greater force with which the blood is urged along

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introduce any subject that may occasion groundless fears, or give any support to the assertion, that a knowledge of the subject by non-professional persons leads to hypochondriacism. I carefully avoided, therefore, noticing more at length, the subject of aneurism, which it was, indeed, unnecessary to say anything particular about. To give the reader, however, some idea of the nature of this afflicting disorder, I have thought it would not be uninteresting to quote the following graphic description from John Bell, of aneurism of the aorta, the largest artery of the body, and which, of course, cannot be stopped like any smaller one. "Among the diseases of the heart," he says, "we may reckon the dilatation of the aorta, a disease more frequent than all the others, and more dreadful. It is a disease more frequent in the decline of life; it is then a disease of weakness. It arises from a cause quite different to that commonly laid down. The celebrated Dr. Hunter believed that it arises from that predisposition, or weakness, which naturally belongs to the form of this part, viz., a sudden angle of the artery, exposed in the most direct manner to the whole force of the heart. Dr. Hunter also believed, that no sooner is nature aware of this danger, than she seeks to prop up the artery, and for this end thickens its walls, till it ossifies (becomes bone) by slow degrees. Halber's theory comes nearer the truth, for he makes these scales of ossification not the consequence, but the cause of the disease. He says, 'The artery becoming scaly, and partly ossified, no longer yields to the force of the heart; and the heart thus excited to a higher action, is itself dilated, and at last forces also the aorta. In truth, neither of these theories is true; but the aorta in aged persons beginning to ossify, has its middle, or muscular coat, annihilated, and its outer and inner coats, thickened by the same process. Its muscular power is lost; it is no longer capable of withstanding, much less of seconding, the action of the heart. It ceases to act, suffers itself to be dilated, and in a few years grows into a dreadful disease. I never saw an old aorta wanting some specks of ossification, or rather of calcareous concretion: nor an aorta so affected, which was not dilated in proportion pretty nearly to the degree of this thickening and ossification; at which we need not wonder, since we find not a bone (as it is usually called ossified aorta) but a vile calcareous concretion substituted for its muscular coat. Nature is not at this time, as Hunter supposed, building up and strengthening the walls of the aorta against this disease, but taking down slowly that fabric which has lasted its appointed time. However it is produced, it is an awful disease; for every organ, when once deranged, especially if it be one as active as this is, never stops in its course, and this especially ends, early or late, in some terrible kind of death Sometimes, increasing in size, it destroys all the surrounding parts, and bursts within. Sometimes it bursts into the chest, and then the patient drops suddenly down; sometimes into the trachea (windpipe) and then the cause of the sudden death is known, for the patient, after violent coughing and ejection of blood by the mouth, expires. Sometimes it beats its way through the ribs, destroys the vertebræ, affects the spinal marrow, and thus the patient dies a less violent and sudden death. Oftenest of all, the tumour rises towards the root of the neck, is felt beating there, destroys the breast bone, bursts up the ribs, dislocates and throws aside the clavicles (collar bones) appears at last in the form of a great tumour upon the breast, beating awfully. A dreadful state! and with nothing to keep in the blood but a thin covering of livid skin, which grows continually thinner, till, bursting at last, the patient expires in one gush of blood. But nature seldom can bear all this distress; the patient dies before this awful scene commences; for the aorta often so fills the chest, so oppresses the lungs, chokes the trachea, and curbs the course of the descending blood, that the system with a poor circulation of all oxydated blood, is quite exhausted. And thus, though the patient is saved from the most terrible scene of all, he suffers great miseries: he feels sharp pains passing across his chest, which he compares with the stabbing of knives and swords; terrible palpitations; often an awful sense of sinking within him; the sound within his breast as if of rushing waters; *a continual sense of his condition;* sudden startings during the night, and fearful dreams and dangers of suffocation; until with sleepless nights, and miserable thoughts by day, and the gradually failing of an ill-supported system, he grows weak, dropsical, and expires." Happily for humanity, these affections are not of frequent occurrence. The imagination of the greatest novelist could not conceive a death more awful; and with whatever kind of death Dickens may intend to close the career of old Ralph Nickleby, he will not portray one more appropriate and more horrible than this. The rarity of such disorders shows how well and how effectually the mechanism of our bodies has been contrived, and how perfectly it performs its duties unceasingly for years.

them, a wound or rupture would be more dangerous than in the veins; these vessels are defended from injury, not only by their texture, but by their situation, and by every advantage of situation that can be given to them. They are buried in sinuses (as in the head) or they creep along grooves made for them in the bones (as in the ribs). Sometimes they proceed in channels, protected by stout parapets on each side, which last description is remarkable in the bones of the fingers, these being hollowed out on the under side, like a scoop, and with such a concavity, that the finger may be cut across to the bone without bursting the artery which runs along it at other times. The arteries pass in canals wrought in the substance, and in the very middle of the substance of the bone. This takes place in the lower jaw; and is found where there would otherwise be danger of compression by sudden curvature." An equal degree of protection is extended to the arteries in passing over joints, where it is evident, unless great care had been bestowed, they would continually be in danger of being twisted, and otherwise injured, from the movements of the limbs. The cause of the superiority of the right arm over the left in regard to strength, is in consequence of the former receiving a greater supply of blood than the latter. It is well known that the right arm is invariably the strongest, and in general this is supposed to be in consequence of use. But whatever influence this may have, there is a physiological advantage possessed by the right arm, which of itself is sufficient to account for the difference. The artery which supplies it with blood, goes off from the aorta more directly, and is larger than that which supplies the left arm; the latter consequently receives a less quantity of blood, the vital stimulus is less, and it is weaker. Bell says, "That, independent of the effect which use may have in strengthening the right arm, it is the peculiar form or direction of its artery which gives it its superior dexterity and strength. When horses are to be broken, we find the chief difficulty to consist in teaching them to move equally with both feet, for they prefer the right. When a dog trots, or when he digs the ground, he goes with his right side foremost, and digs chiefly with his right foot; and in these creatures we find the same arrangement of the arteries as in ourselves. When we lose our arm, the left hand acquires by use all the strength and dexterity of the right. Since, then, either arm can acquire this dexterity, and since the right leg is stronger by its dependence upon the motions of the right hand, we have every reason to believe, that the preference given to the right hand has some physical cause, and that it is the peculiar form of its artery in going off more directly on the right side. In birds, whose wings are of equal strength, the arteries which supply them with blood are sent off from the aorta direct on each side, and they are also equal in size and form; so that one wing receives exactly the same quality and quantity of blood as the other.

(To be continued.)

EFFECTS OF THE ATMOSPHERE AND ELECTRICITY ON THE HUMAN BODY.

(From Dr. Sigmond's Treatise on the Use of Mercury.)

The older physicians laid particular stress upon the influence of the sun and moon upon human bodies; and Dr. Mead has collected some very curious instances to prove the influence of the planets. Modern science and experience have shown, that although the paroxysms and periods of disease are guided by regular laws, there is no reason for the belief that the celestial bodies are in any way connected with them, but that they are dependent on atmospheric changes. We find, under particular aerial states, that epidemics are prevalent, and that their cure must vary according to the changes that produced them; and medicines will, under such circumstances, lose much of their power, and even be productive of evil consequences. During fine clear weather, the preparations of mercury seldom affect the bowels, nor do they produce that depression of spirits which is so often observed to accompany their use during damp moist weather. This does not altogether depend upon the state of atmosphere determining from the outward surface, and preventing a free action of the skin, because the coldest weather, if it be dry, is well adapted for its administration. It seems in some measure to be connected with the electricity of the body. We are well aware, if the weather be damp and foggy, that a listless and languid state is produced; while during dry weather, however cold it may be, there is a feeling of light-heartedness and cheerfulness pervading the whole system. In the first instance, the atmosphere is robbing us of our electricity, which it greedily absorbs; in the latter case, the dryness of the air is such, that it leaves us in possession of the electricity which seems to belong to us:

hence the buoyancy of spirits on the cold frosty days of December and January, and the suicidal despondency of November; and hence the elasticity, the life, and animation of the Frenchman—the sluggish, heavy movement of the Dutchman—the variable feelings of the Englishman—one day full of hope and cheerfulness, the next day at war with himself and the rest of mankind. During moist states of the weather, mercurial preparations should be sparingly prescribed ; and when, from the diseased state of the system, they cannot be dispensed with, very great attention is to be paid to the clothing. To everyone in damp moist conditions of the atmosphere, flannel is a great comfort, but silk is the most useful covering of the body. It is by far the best friend and comforter that can be applied. We know that if a silk handkerchief be perfectly dry, lightning the most accumulated could not pass through it, so decided a non-conductor is it; hence, if worn next to the skin, the air cannot absorb the electricity of the human body. Silk waistcoats, drawers, and stockings of the same material, are of the greatest service during the humid state of the winter months of this country. The hypochondriac, the nervous, will derive from them more benefit, than from the most active tonic, and they will prove a more invigorating cordial than any spirituous dram ; nor are the effects transient, for a buoyancy of spirits and an agreeable warmth are thus diffused over the whole frame.

AUSTRALIA.

The increasing importance of this vast continent, and the distress which unhappily exists among a considerable portion of our countrymen at home, render every information concerning places reputed eligible for emigration, not only important to those who contemplate quitting this country, but also a subject of deep interest to all good men who are anxious for the well-being of their brethren.

At the last sitting of the Geographical Society, Lord John Russell communicated a letter from Captain George Grey, containing

A Summary of the Discoveries made and objects attained, during an Expedition on the Western Shores of Australia, in the months of February, March, and April, 1839.

The district examined during this expedition, lies between Cape Cuvier and Swan River, having for its northern limit the parallel of 24° S. lat., and for its southern limit the parallel of 32° S. lat. This expedition combined two objects, the examination and nautical survey of such parts of the coast lying between these limits as were imperfectly known, and the exploration of such parts of the continent as might on examination appear worthy of particular notice. The materials for the construction of a chart of that portion of the coast, which had been only so imperfectly delineated by Van Keulen, were first collected ; a survey of the unknown parts of Shark's Bay was then completed ; in addition to these, I have also the materials requisite to construct a map of the country lying between the limits above named, sometimes extending to the distance of forty miles from the coast. Ten rivers, which are, when considered with reference to the other rivers of Western Australia, of considerable importance (some of them being larger than any others yet found in the south-west of this continent) have been discovered, besides many smaller streams. The rivers I have named the Gascoigne, the Dule Ion (or Difficult Mouth) the Hutt, the Irwin, the Murchison, the Arrowsmith, the Smith, the Greenough, the Garbanap, the Belve-new-Map (or Diminutive River). Two mountain ranges have been discovered. One first seen at the northern extremity of the "Darling Range," and about thirty miles to the eastward of it, lofty and altogether differing in character from the Darling Range, which at this point is called "Moresby's Hat-topped Range ;" its direction is nearly north and south. I have taken the liberty of calling this Range after Her Most Gracious Majesty, "The Victoria Range ;" and the extensive district of fertile country extending from the base of this range to the sea, and having a length of more than fifty miles in a north and south direction, I have also named the "Province of Victoria," in honour of Her Majesty, trusting Her Majesty will not object to bestow her name upon one of the finest provinces in this her new, vast, and almost unknown empire—and which, protected in its very birth and infancy by her fostering hand, will doubtless, ere long, attain to no mean destiny among the natives of the earth. The other range is thrown off in a westerly direction from the "Darling Range"—it is about forty miles in length from north to south, of a bare, sterile, and barren nature, and terminates seaward in "Mount Perron" and "Mount Le Sueur." To this range I have given the name of "Gairdner's Range ;" it forms a very important feature in the geo-

graphy of this part of Australia. Three extensive districts of good country have been discovered in the course of this expedition. The "Province of Victoria" before alluded to, the district of "Babbage," and that of "Gabba-Boola," or Water Abundant. The Province of Victoria is situated between the parallels of 28^0 and 29^0 S. lat.; its most considerable river is the "Hutt," which disembogues into a large estuary. A few miles below the estuary the river separates into two branches, both of which were running strong at the time we passed them. Previously to our reaching the "Hutt," our boats had all been wrecked; I had therefore no opportunity of examining whether the estuary of this river was navigable or the contrary. From its size, however, I conceive that it must be navigable. The other principal streams which drain this district, are the "Irwin" and the "Murchison." One remarkable feature in the "Province of Victoria" is, that the carboniferous series is here developed. Throughout a tract of country in Western Australia, extending in latitude from the bottom of "Geography Bay" to "Cape Cuvier," and which I have carefully examined, the point above alluded to is the only one in which I have yet found the rocks belonging to this series. This circumstance, therefore, imparts a very high degree of interest to this district. The district of "Babbage" is situated on and near the River Gascoigne, in Shark's Bay. This river discharges itself into the bay through two mouths, between which lies "Babbage Island." The most southern of these mouths is situated in 24^0 57′ south latitude. This river is the most southern river that I have ascertained to be deficient in that universal characteristic of the rivers in the south-west of this continent—a bar estuary. I have not seen the mouths of three or four of the rivers before enumerated; I cannot, therefore, say that they discharge themselves into estuaries; but at the same time I cannot say that they may not do so. Whereas, the Gascoigne has no estuary, at least in the sense that the term estuary is used in this country, but two mouths of considerable magnitude. This river is also the most northern river on the western side of this continent, where the rise and fall of tide is sufficiently great to exercise any influence upon it relatively to the purposes of navigation. The rise and fall of the tide here is about 5½ feet; but there is only one regular tide in twenty-four hours. The first tide rises to a certain point, and, ere it has scarcely commenced to ebb, the second tide comes slowly in; so that, to a careless observer, only one tide is perceptible. The district of Gabby-Boola lies immediately to the north of Perth. The largest river in this district is the Garbanap; it, however, contains four other rivers, the Moore River, the Belve-new-Map, the Smith, and the Greenough, or Moore River, about 50 miles to the north of Perth, was before known; a few miles to the north of this river lies the Belve-new-Map; and about 25 miles to the north of Moore River is the Garbanap; into this Moore River discharges itself about nine miles from the sea. The Greenough is situated between this point and "Gairdner's Range," and immediately under this range lies the Smith, which is a large river, even at the distance of thirty miles from the sea-coast. Gairdner's Range is naturally the northern limit of this district, which is connected with Perth by a chain of fresh-water lakes—the greatest distance between any two of which is not more than from four to six miles. The whole of this district is therefore immediately available, and affords a gratifying proof that this flourishing colony is by no means deficient in good and immediately available land. The circumstance also of this district being so abundantly supplied with water, even at the end of an uncommonly dry season, which is the period I traversed it in, much enhances its value. There was one other district examined by us, which possesses such peculiar characteristics, that even in this short report I am induced to call your Lordship's attention to it. I have named this the district of "Koo-him-buit," that is, the district of "Falsehood" or "Deceit." It is situated between a point lying about ten miles to the north of the northern mouth of the Gascoigne and Cape Cuvier, the whole extent of its sea-coast is bounded by a range of lofty sandy dunes, having a width inland of not more than from 2 to 2½ miles. The first time that I ascended this range was on the morning of the 8th of March, 1839, at a point about fifteen miles to the south of Cape Cuvier. On looking to the eastward, I was surprised to see an apparently boundless expanse of water in that direction. I hurried back to the boats and selected three men to accompany me in my first examination of the shores of this inland sea. When we gained the top of the sand-hills, the surprise of the party was as great as my own, and they begged me to allow them to return, and endeavour, by the united efforts of the party, to carry one of the whale-boats over the range, and at once launch

it on this body of water. I, however, deemed it more prudent, in the first instance, to select the best route along which to move the whale-boat, as well as to choose a spot which afforded facilities for launching it. In pursuance of this determination, we descended the eastern side of the sand-hills, which abruptly fell in that direction, with a slope certainly not much exceeding an angle of 45°. I now found that the water did not approach so near to the foot of the hills as I had at first imagined; but that immediately at the foot of these hills lay extensive plains of mud and sand, at times evidently flooded by the sea, for on them lay dead shells of many kinds and sizes, as well as large travelled blocks of coral. The water now appeared to be about a mile distant; it was also apparently boundless in an easterly and north-easterly direction, and was studded with islands. We still felt convinced that it was water we saw, for the shadows of the low hills near it, as well as those of the trees upon these hills, could be distinctly traced on its unruffled surface. As we continued to advance, the water, however, constantly retreated before us, and at last surrounded us. We had been deceived by mirage! The islands are really so when the plains are covered by water. In many places the sandy mud was still so moist, that we sank deeply into it, and, after travelling for fifteen miles on a N.E. course, I could still see no limit to these plains in a N.E. direction, nor could I either then, or on any subsequent occasion, find the channel which connected them with the sea. We dug in several places in these flats, and in their vicinity, but could only find salt water; whereas in the narrow range of sand-hills separating them from the sea, we found abundance of fresh water only four or five feet below the surface of the valleys between these hills. As this range of hills, more than thirty miles in length, offers many geological phenomena, I have named it "Lyell's Range," in compliment to the distinguished geologist of that name.

THE CHEMIST.

THE ELEMENTS AND THEIR COMBINATIONS.

(Continued from page 147.)

Hydrogen was first examined in its pure state by Mr. Cavendish, in 1766. It was termed *inflammable air*. To procure it, let sulphuric acid, previously diluted with six or eight times its weight of water, be poured upon iron filings or granulated zinc in a gas bottle, an effervescence will immediately ensue, and the evolved gas may be received in the ordinary manner by the hydro-pneumatic apparatus. It may also be procured by heating turnings of iron heated to redness in a gun-barrel. The hydrogen, however, which is thus obtained is never perfectly pure. When procured by the means of iron, its odour is peculiarly disagreeable, in consequence, according to Berzelius, of its containing a portion of volatile oil formed by its union with a minute quantity of carbon, which all common iron contains. For the purpose of delicate experiments, hydrogen must be passed through a solution of potassa collected over mercury, and should be procured from purified zinc and sulphuric acid so far diluted as to act slowly on the metal. The hydrogen liberated by the voltaic decomposition of water by platinum wires, may, when dried, be considered perfectly pure. Hydrogen is a uniform fluid not absorbable by water unless that liquid has been previously deprived, by boiling, of common air, in which case 100 cubical inches dissolve about 1.5 cubic inches of the gas; it has no taste, and when perfectly pure is inodorous. It is the lightest body known, and we therefore conveniently assume it as unity in speaking of the specific gravity of gases. It is inflammable and extinguishes flame. When pure, it burns quietly with a lambent blue flame at the surface in contact with air, but if mixed with thrice its volume of air it burns rapidly and with detonation; it is the body which gives the power of burning with flame to all the substances used for the economical production of heat and light. In making the detonation experiment with hydrogen, a strong bottle, capable of holding about six ounces of water may be employed, but it should be wrapped round with several folds of cloth to prevent the glass being scattered about. In examining into the quantity of atmospheric air required to form an explosive mixture with hydrogen, Mr. Cavendish found the loudest report was produced by two volumes of hydrogen with six of air. One of hydrogen with nine of air burned very feebly, and four of hydrogen with one of air burned without explosion. If two volumes of hydrogen and one of oxygen be burned in the vial in the same manner as before stated, the explosion is extremely violent; but if the mixture be diluted with eight measures of hydrogen or nine of oxygen, it becomes uninflammable.

Hydrogen, in consequence of its extreme lightness is employed for filling air-balloons. If an inverted jar of this gas be brought over the wick of a lighted candle, and suddenly depressed, so that the flame may be entirely surrounded by the gas, it will be extinguished, although the gas will burn in contact with the atmosphere. On account of the extreme levity of this gas, it may be apparently breathed some time without inconvenience, provided that the lungs at the outset are filled with common air; but if a forcible expiration be made before drawing in the hydrogen only two or three inspirations of the latter can be made, and even these produce great feebleness and oppression about the chest.

J. MITCHELL.

(*To be continued.*)

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith-street.—Thursday, Feb. 13, Mr. Sainsbury, on Chemistry. At half-past eight.

Poplar Institution, East India-road.—Tuesday, Feb. 11, General Meeting. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney-road.—Tuesday, Feb. 11, G. Francis, Esq., on Modelling and Casting. At eight o'clock.

QUERIES.

A receipt for the preparation of the creta lævis?
J. F. B.

How to make a good red black spangled wax?
P. Y. H. N.

Where to get two glass cylinders of the following dimensions—1 and 2 inches in diameter, and 2 to 4 inches long? TYRO CHEMICUS.

1. What is the best and cheapest book extant on the formation of millgeering? 2. Which is the best mode of drawing an epscycloid? 3. The best mode of striking out bevel wheels? 4. Which is the best method of forming the teeth of large wheels? YOUTH.

I find that in No. 63 (N.S.) "T. L." has kindly offered to give information on the construction of a velocipede; I shall feel it a great favour to receive a plan of one on the best principles? Also the best way to piece China to hold hot water, and to make holes in it? How to colour coral that has been made white through being heated? Will soda or potash counterfeit coral instead of wood ashes; if not, what kind of wood is best to make the lye? A. ADAMS.

How to make modelling-wax? P. T.

ANSWERS TO QUERIES.

To make Gas which takes Fire on coming into contact with the Air.—Put a piece of phosphuret of calcium, or phosphate of lime, into a glass of water; the water will be decomposed, and phosphuretted hydrogen produced, which will take fire as the bubbles reach the surface. To make phosphate of lime, put some pieces of red-hot lime into a basin, throw upon them a piece or two of phosphorus, and cover the basin instantly with a board. Let it remain till cold.

W. W.

To make Congreve Matches.—Take 1 part phosphorus, 1 nitre, 1 chlorate of potash, 1 sulphuret of antimony, 3 gum water of the consistency of cream. Place them in a cup, and set the cup in hot water. As the phosphorus melts, stir the ingredients together till thoroughly evaporated. Dip sulphured matches into the mixture.

Wallace's "Mathematician's Pocket Guide," contains logarithms of numbers to 10,000, as well as of sines and tangents, and costs but a trifle. It is, indeed, an excellent little book.

W. W.

TO CORRESPONDENTS.

Wm. Jonquest.—*Several modes of constructing garden fountains have been described in former numbers of this work; a simple jet is produced by a water-butt or other reservoir being placed a few feet higher than the fountain, and a tube to convey the water to the jet, when the force of projection will be found proportional to the height of the water in the reservoir above the mouth of the fountain, whatever may be the position or devious course of the tube.*

Tyro Chemicus.—*We not only take great interest in the success of the society he is about to form, but shall be most happy to do all in our power to promote its success. The letter addressed to "J. C." we have forwarded by post. He will receive all the information of which we are possessed, upon the subject of his inquiry.*

J. Kentish *will find his request complied with.*

J. C.—*We are happy to announce, that our worthy and talented correspondent, "G. Piesse," is disposed to join a society of the kind spoken of by "J. C." and "Tyro Chemicus." He says, "I am willing to join any party for the formation of a society as spoken of by 'J. C.', 21, Great Newport-street. Should any of the readers be of the same inclination, let us hold a meeting; anywhere that is mentioned will suit me." We should recommend by all means that the above gentlemen meet, and, if they agree, success is certain.*

J. Yates's *solution shall appear in our next number.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell-street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 76 & 77, NEW SERIES. | SATURDAY, FEB. 15, 1840. (PRICE TWOPENCE.) | Nos. 197 & 198, OLD SERIES.

OPTICAL INSTRUMENTS.

FIG. 1.

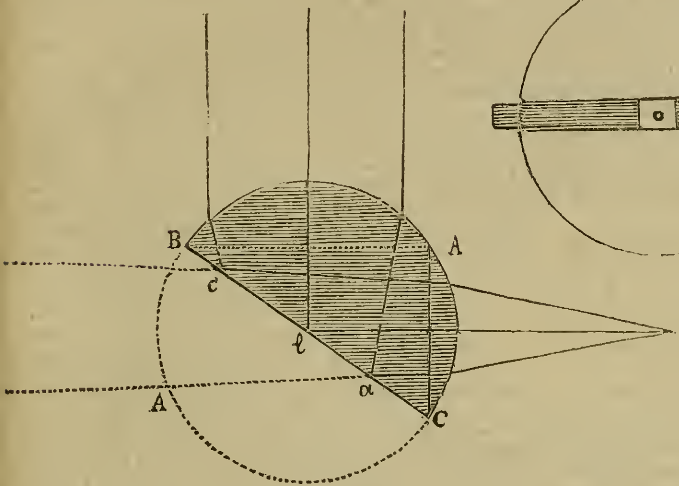


FIG. 2.

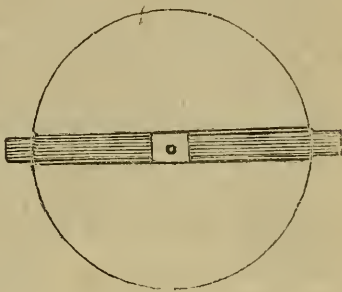
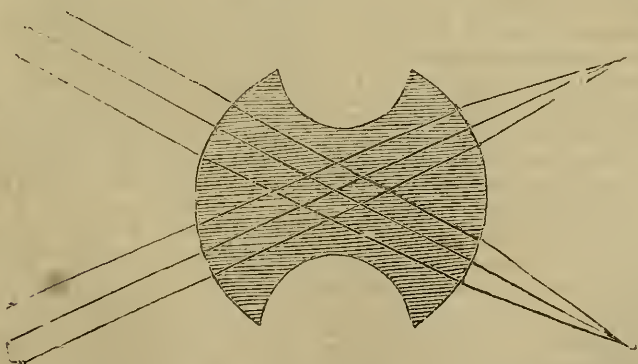


FIG. 3.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

OPTICAL INSTRUMENTS.

NO. VI.

(See Engraving, front page.)

A MICROSCOPE is an optical instrument for examining and magnifying minute objects. Jansen and Drebell are supposed to have separately invented the single microscope, and Fontana and Galileo seem to have been the first who constructed the instrument in its compound form.

Single Microscope.—The single microscope is nothing more than a lens or sphere of any transparent substance, in the focus of which minute objects are placed. The rays which issue from each point of the object, are refracted by the lens into parallel rays, which, entering the eye placed immediately behind the lens, afford distinct vision of the object. The magnifying power of all such microscopes is equal to the distance at which we could examine the object most distinctly, divided by the focal length of the lens or sphere. If this distance is five inches, which it does not exceed in good eyes when they examine minute objects, then the magnifying power of each lens will be as follows :—

Focal length in Inches.	Linear Magnifying Power.	Superficial Magnifying Power.
5	1	1
1	5	25
$\frac{1}{10}$	50	2,500
$\frac{1}{100}$	500	250,000

The *linear* magnifying power is the number of times an object is magnified in length ; and the *superficial* magnifying power is the number of times that it is magnified in surface. If the object is a small square, then a lens of one-inch focus will magnify the side of the square five times, and its area, or surface, twenty-five times. The best single microscopes are minute lenses, ground and polished on a concave tool; but as the perfect execution of these requires considerable skill, small spheres have often been constructed as a substitute. Dr. Hook executed these spheres in the following manner :—Having drawn out a thin strip of window-glass into threads by the flame of a lamp, he held one of these threads with its extremity in or near the flame, until it ran into a globule. The globule was then cut off, and placed above a small aperture, so that none of the rays which it transmitted passed through the part where it was joined to the thread of glass. He sometimes ground off the end of the thread, and polished that part of the sphere. Father di Torre, of Naples, improved these globules, by placing them in small cavities in a piece of calcined tripoli, and remelting them with the blowpipe; the consequence of which was, that it assumed a perfectly spherical form. Mr. Butterfield executed similar spheres, by taking upon the point of a wetted needle some finely pounded glass, and melting it by a spirit-lamp into a globule. If the part next the needle were not melted, the globule was removed from the needle, and taken up with the wetted needle on its round side, and again presented to the flame, till it was a perfect sphere. M. Livright, of Megget-land, has made lenses by putting pieces of glass in small round apertures, between the tenth and twentieth of an inch, made in platinum leaf. They were then melted by the blowpipe, so that the lenses were made and set at the same time. Mr. Stephen Gray made globules for microscopes, by inserting drops of water in small apertures. Dr. Brewster made them in the same way with oils and varnishes; but the finest of all single microscopes may be executed by forming minute plano-convex lenses upon glass with different fluids. The most perfect single microscopes ever executed of solid substances, are those made of the gems, such as garnet, ruby, sapphire, and diamond. Lenses made of these stones perform admirably, in consequence of their producing, with surfaces of inferior curvatures, the same magnifying power as a glass lens ; and the distinctness of the image was increased by their absorbing the extreme blue rays of the spectrum. Mr. Pritchard, of London, has carried this branch of the art to the highest perfection, and has executed lenses of sapphire and diamond, of great power and perfection of workmanship.

When the diamond can be procured perfectly homogeneous and free from double refraction, it may be wrought into a lens of the highest excellence. Garnet is decidedly the best material for single lenses, as it has no double refraction, and may be procured, with a little attention, perfectly pure and homogeneous. A single microscope, which Dr. Brewster used, is shown in fig. 1, and consists in using a hemispherical lens, so as to obtain from it twice the magnifying power which it possesses when used in the common way. If A B C is a hemispherical lens, rays issuing from any object, B, will be refracted at the first surface, A C, and after total reflection at the plane surface, B C, will be again refracted at the second surface, A B, and

emerge in parallel directions, *d e f*, exactly in the same manner as if they had not been reflected at the points, *a b c*, but had passed through the other half, B A C, of a perfect sphere, A B, A C. We obtain, consequently, by this contrivance, all the advantages of a spherical lens, which has never been executed by grinding. The periscopic principle, which I shall presently mention, may be communicated to this *catoptric* lens, as it may be called, by merely grinding off the angles, B C, or roughly grinding an annular space on the plane surface, B C. The confusion arising from the oblique refractions will thus be prevented, and the pencils from every part of the object will fall symmetrically upon the lens, and be symmetrically refracted.

Dr. Wollaston proposed a method which is shown in fig. 2. He introduced between two plano convex lenses of equal size and radius, a plate of metal with a circular aperture equal to one-fifth of the focal length; and when the aperture was well centered, he found that the visible field was 20° in diameter. In this compound lens the oblique pencils pass, like the central ones at right angles, to the surface. If we compare this lens with the *catoptric* (one above described) we shall see that the effect which is produced in the one case, with the two spherical and two plane surfaces, all ground separately, is produced in the other case, by one spherical and one plane surface. Dr. Wollaston's method may, however, be improved by filling up the central aperture with a cement of the same refractive power as the lens; or, what is far better, by taking a sphere of glass and grinding away the equatorial parts, so as to limit the central aperture, as shown in fig. 3; a construction which, when executed in garnet, and used in homogeneous light, will be the most perfect of all lenses, either for single microscopes, or for the object lenses of compound ones. When a single microscope is used for opaque objects, the lens is placed within a concave silver speculum, which concentrates parallel or converging rays upon the face of the object next the eye.

A. D. M.

STEAM NAVIGATION.

To the Editor of the Mechanic and Chemist.

Sir,—Annexed we have the pleasure to hand you the result of an experiment made by us on board the *Maria*, of applying steam power as an auxiliary aid to shipping during calm light weather.

From a careful inspection of the *Maria's* logbook, and Captain Black's memoranda, we find, that the two ten-horse engines with which the ship was fitted, propelled her in a calm, at the rate of three miles per hour. When the ship's draught of water, and the smallness of the power employed, are considered, this result of a first experiment must be deemed by nautical men as very satisfactory. The obstacles to complete success are of a description easily overcome; and such data have been afforded for farther improvements, as experience alone could furnish.

Having at our sole expense fitted this, the first ship, with steam-power for occasional use, we shall be happy to afford Her Majesty's Government, the Honourable East India Company, or any public body, all the information in our possession on this very important subject. There cannot, we imagine, be any difference of opinion respecting the utility to all sailing vessels on distant voyages with troops, emigrants, &c., of this partial application of steam-power; at the same time it must be obvious, that the repetition of similar undertakings, or the establishment of a line of packet ships for the passengers and trade to and from India, fitted like the *Maria*, involves an outlay of capital which few private individuals possess the means of expending.

The experiment referred to, forms our contribution towards effecting so great an improvement in navigation; we have now only to express our undiminished confidence in Mr. Melville's invention, and hope it may be generally adopted for the advancement of the naval and commercial interests of our country.

Your obedient servants,
Gardner, Urquhart, & Co.,
Owners of the Ship *Maria*.

11, St. Helen's Place, London,
20th January, 1840.

It appears from an abstract of the logbook, that, during the voyage, the steam-power was used on forty-five different occasions, and during a period of 511 hours = 21 days, 7 hours. If the result has proved less brilliant than might have been anticipated, it was owing to the appointment of improper persons as engineers. The following extracts from the logbook will show under what disadvantages the experiment was conducted:—Feb. 12: "Found engineer neglectful and inefficient. March 17: At 3 a. m., lighted the fires: but, owing to the ignorance and neglect of engineers, did not get the steam up until 9 a. m." Upon almost every occasion on which the steam-power was used, the discreditable conduct of one or both of the engineers is recorded; one of them

was for a period kept in confinement for theft and drunkenness. Notwithstanding these unfavourable circumstances, the occasional application of steam-power appears to have considerably shortened the period of the voyage; indeed there is little doubt of its ultimate adoption, not only in trading vessels, but also in the Royal Navy—especially in the latter, where the celerity of movement is of such vast importance during an engagement.

ON LIFE ASSURANCE.

(*Continued from page* 171.)

Most of our readers must be acquainted with the mariners' legend of the "Flying Dutchman." An unearthly being, supposed to be the commander of the *Phantom Ship*, is represented to be constantly contriving pretences for delivering a letter to the captain of some devoted vessel; and, when he succeeds, the vessel, on board of which the letter has been received, is doomed to certain and speedy wreck and destruction. The enticing prospectuses of fraudulent Assurance companies have often brought more misery and ruin to families, than credulous seamen have supposed the Dutchman's letter to entail upon a ship. During the short period which has elapsed since we intreated our readers to beware of delusive advertisements, and keep their money secure from intriguing and heartless speculators, another "breaking up" is added to the list of 37 mentioned in a former article. The "Royal Union Association" has ceased payment, and thereby inflicted utter ruin upon many poor and honest families. One old lady had invested 500*l*. in this "concern;" it was all she possessed in the world, and would have produced her a comfortable income for the rest of her days—she must now be locked up in a workhouse prison, to pine away till grief and fruitless regret shall close her poor eyes in that long sleep, which is the only solace for the child of misfortune and adversity. The following extract from the proceedings before the magistrates at Bow Street, exhibits the feeling of just indignation excited among the numerous victims; many of whom had come from Scotland and other distant places, in the hope of recovering some wreck of their property:—

"Mr. Twyford said, that however much he might regret the misery which the state of the Society's affairs would entail upon numerous parties who were ill able to bear up against it, still he was of opinion that the case was one in which he could not render any assistance; in fact, it was clear, that whatever proceedings might be adopted, the annuitants would never get back one penny of their money.

Mr. Cheaper said, that the public ought to be furnished with a list of the names of the parties, on the faith of whose responsibility people had been induced to trust their money with the Society.

Mr. Cross begged that their names might not be mentioned.

Mr. Cheaper.—Why not? They have drawn unsuspecting people into a snare, and totally ruined them. It is a disgrace to the country that such a thing should be tolerated. Thank God I am better able to bear the loss I have sustained than the poor people by whom I am surrounded!

Mr. Mingay said, he had invested 200*l*. in the Society within the last six months, for which he had never received a farthing interest.

[Here there were loud exclamations of 'Is there no way of bringing the rascals to justice? They ought to be hung. The attorney ought to be ashamed of such clients.']

Mr. Cross said, that a bill in Chancery had been filed by one of the annuitants, a Mr. Colesbrook, of Newbery, calling for an account of the manner in which the funds of the Society had been disposed of, that account was being prepared, and would be filed as soon as possible."

We shall return to this important subject, and perform the more pleasing task of examining the principles of some of the substantial, honourable, and benevolent institutions, which are as deserving of support, as others are of the universal execration they have called down upon themselves.

(*To be continued.*)

LOAN SOCIETIES.

To the Editor of the Mechanic and Chemist.

Sir,—You having treated some information upon "Loan Societies" most judiciously in your last number, and, considering as I do, that the subject cannot be unsuited to those of your readers, who, from the very nature of some of their projections, would be apt to avail themselves of a loan; permit me to call your attention to a few words farther upon the subject. In doing this, I alike address myself to those who may, and those who may not, require loans.

The statements of "W. M'C," which you strongly commented upon, I deem a decidedly moderate example of more than fifty societies in the metropolis. How far I may be considered to possess grounds

for this assertion, let the following experience testify. I have carefully examined the rules of many of these societies, and adduce the fact, that very little deviation is made from the following principle; namely, 1. Interest; 2. Entrance money; 3. Cost of books and papers; 4. Securities' expenses; 5. Reserve fund to meet losses; 6. Secretary's salary; 7. House rent, of course chargeable in common to all; but should there be any default, there is added, 8. Expense of writing letters; 9. Postage; 10. Fines. It is needless to proceed farther. I read in the first section of the Act which empowers those persons who commit such depredations on the pockets of our valuable artisans and mechanics under a mask, that this statute was created to "assist the working classes of Great Britain." And is it possible, some may ask, that such freedom is taken with our legislature? Certainly it is possible; for a clause gives them also the power to make rules for "management" and "expenses;" and a farther clause to make these rules "binding" on all parties; so that where "joint-stock" affairs, with raised capital, &c., are to be found, such unprincipled means of extortion are generally practised. I am aware of an individual some time since lending 100*l.* to one of these companies, and, at the end of the year, his dividend was 20*l* ! Mark, this Society was held at a publichouse; and it is astonishing to me, that with all our advances to the "city of science," our *assistance* societies are found to retrograde thus in the path of scorn; for I hold it but an honourable appellation to the names of all your readers (many of whom I personally know) that their exalted aim is to expel this demoralizing bane from the page of their research; yet, if borrow they would, not only is the pocket robbed, but the senses too: it becomes a disgrace to put in practice their motto, "No spending money;" for never did any of their patrons (I mean publicans) ever anticipate such a thing.

You have given your readers, Sir, a very correct outline of the old system; permit me now to introduce the new. It would be easy enough to swell the scale of comparison between the two, but I forbear; enough has been said upon that score.

Let then, for example, a Society be formed to advance sums under the statute quoted, of 10*l.* or 15*l.* to each person, and let the interest of five per cent. be deducted at the commencement, as being more convenient to both borrower and lender; and this the Act permits. Then, with a sufficient security, a person might pay back 10*l.* in twenty-five weeks by 8*s.* each instalment, without addition. The person to whom the 10*l.* had thus been lent, would be indeed assisted; for it is clear, all he ever paid was interest 5*s.*! and would be at liberty to use another 10*l.*, or even 15*l.*, the remaining half-year. Now by returning by instalments his money regularly, which puts fines out of the question, the Society have, it is true, realized rather more than 5 per cent; but not enough to make good losses; neither is a bare five per cent. expected to pay expenses; but I could show a just and honourable method by which the borrower should pay no more, and yet the Society be not subject to the loss of expenses of management. This I will make the subject of another paper; in the mean time allow me to state, that this Society does exist precisely upon the principle stated, only making a little distinction with regard to security, which no industrious man could object to; and it is probable that this will meet the eyes of some who have been "assisted" thereby during the past year, and the truth will need no confirmation. No advertisements or flaming handbills have been issued, as is usual; for the question, Who would pay it? Should the borrowers?

I remain yours, &c.,

SIGMA.

ON COMBUSTION.

In a chemical sense, this term is applied to all those cases of combustion which are attended with the evolution of heat and light. Combustion in atmospheric air (which branch I intend to examine) is simply the combinations of the oxygen it contains. We are indebted to Lavoisier for the true theory of combustion; he attributing it to the combination of inflammable bodies with oxygen; heat and light being evolved by the fact of gases containing a larger quantity of caloric than liquids, and liquids than that of solids. Gaseous bodies emit the greatest quantity of light while they are burning, a flame being produced by their combustion. Solids give a fixed light. Coals producing flame from the volatilization of the gaseous matter; but when expelled, producing a fixed light. Sir Humphrey Davy supposes, that the degree of light depends on the quantity of solid matter present in the burning gas. When any solid substance is introduced into a feeble flame, it becomes brighter, and, if combustible, brighter still. A considerable quantity of carbon is disengaged from carburetted hydrogen dur-

ing its combustion, which gives that brilliancy to the flame.

A candle may be compared to a small gas manufactory, where the gas is consumed as it is produced. The flame of a candle is produced by the oxygen of the air acting upon the outside of the formed gas; water and carbonic acid being produced by its combination. The flame of a candle is hollow, assuming the conical form, in order to be supplied with oxygen, as fig. 1. But if a heated wire be passed down the centre of the wick, and through the side, and then drawn out so as to leave a passage for the air, the flame will assume the form of fig. 2; it then being

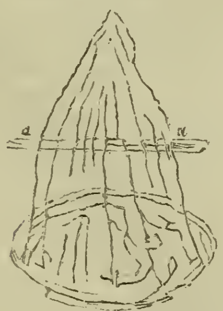
FIG. 1.

FIG. 2.

supplied with a current of oxygen on both sides of the flame. The following experiments prove that flame assumes the form of a hollow cone, when a current of air is not allowed to pass through it.

Exp. 1. Take a small plate, about two inches in breadth, and pour a little spirit of wine in it; upon setting fire to it, it will assume the conical form; take a piece of chip, and hold it through the centre of the flame, it will be found to burn only at the points, *a a*, fig. 3; the centre falling through.

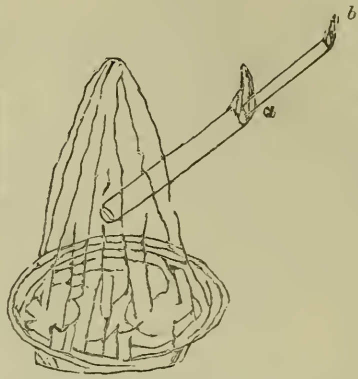
FIG. 3.



Exp. 2. Place a piece of phosphorus in the centre, it will not be inflamed; in the same way sulphur, &c.

Exp. 3. If a glass tube be introduced within the flame of the burning spirit, in the manner represented in fig. 4, part of

FIG. 4.



the unconsumed vapour passes through, and may be kindled at *a*. The wider the tube the better; if the flame is sufficiently large, and a tube being thrust into the flame at *a*, the vapour may be also kindled at *b*. This experiment is best done with a large candle, and proves that the centre of a candle, lamp, &c., is filled with the unconsumed gas, which rises to be decomposed in its turn.

FELIX WEISS.

Liverpool, Feb. 4.

ON THE CIRCULATION OF THE BLOOD.

(*Continued from page* 194.)

ANOTHER peculiarity connected with the arteries, is the manner in which they are distributed to the different organs of the body. As they alone convey the vital stream that carries with it life and nourishment, we might naturally conclude, that the most important organs would have the greatest number; and such we find to be the case. According to the importance of a part, so is its supply of arterial blood. The brain, for instance, being the centre of sensation, and the source of life and action, receives more blood than any other portion of the body. It has four large arteries, which rise almost direct from the heart; and these vessels communicate so freely with each other by means of branches, that if three were stopped up, the fourth would supply their place for a time. There are no vessels, indeed, in any part of the body that so

freely communicate with each other, as those of the brain; and the importance of this arrangement will be obvious, when it is considered, that if the supply were cut off even for a few seconds, death would instantly ensue. How astonishing it is to think, that every moment of our lives there is a constant current of blood rushing to our brains, and yet that we are quite ignorant of the fact, except in periods of great excitement, when we may feel it throbbing in our heads; or in those disorders where our being sensible of the circumstance is the occasion of continual pain and misery! "The four arteries just mentioned, alone convey to the head," says John Bell, "the fifth part of the whole mass of blood." Even those who settle it at the lowest point, still acknowledge that the arteries going to it receive at least a tenth of all the blood of the body. Thus the brain, which weighs not above the fortieth part of the whole body, receives one-tenth of all the blood! Besides the profusion of blood which thus rushes into the brain, the impetus with which it forces its way seems dangerous; and Nature also seems to have provided against the danger. We cannot but be sensible of the danger, for the slightest increase of velocity occasions strange feelings, if not absolute pain. We cannot run for any distance, nor ascend a stair rapidly, nor suffer a paroxysm of fever, nor, in short, have the circulation quickened by violent exertions, by emotions of the mind, or by disease, without feeling an alarming beating within the head. If it continue from disease, or we persist in our exertions, giddiness, blindness, ringing of the ears, come on. Haller, the celebrated physician, says, that while he was afflicted with a bad fever, he suffered so much from the pulsation of the artery within the skull, that his head was lifted from the pillow at every stroke. Did this vast column of blood rush directly to the brain, which is more delicate in its structure than any other organ of the body, the most serious consequences would follow. In order, therefore, to break the force of the ascending current, many beautiful contrivances have been adopted. In man, the blood is retarded chiefly by the tortuous course which the artery is obliged to follow; and by a long bony canal, which, by holding the artery, as in a sheath, suppresses its violent action, and prevents its being dilated by the force of the blood. It is also peculiar in all the arteries of the brain, that they do not enter in trunks into its substance. This seems to be a violence which the soft texture of the brain could not bear; all the arteries are, therefore, attached to an exceedingly delicate membrane (the pia mater) which is the immediate covering of the brain, which follows all its divisions, lobes, and convolutions; which enters all its cavities, and lines its internal surfaces, as it covers the external. This is the membrane of the brain to which the arteries attach themselves. It conducts them everywhere along the surface of the brain, and into its cavities; and, when the arteries are to enter into the substance of the brain, they have already branched so minutely upon this membrane, that they enter into the pulpy substance in the most delicate twigs. In the lower animals, especially in the calf, the deer, the sheep, which hang their heads in feeding, there is a provision of so singular a nature, that we can have no doubt that these contortions of the great trunks and minute divisions of the smaller arteries in man, have the same final cause; for in those creatures the principal arteries, before they enter the brain, first divide into innumerable small arteries. Not one of these is sent off for any particular function; but they are immediately united again, and gathered together into one trunk, and then the force of the blood being thus broken, the artery divides a second time into branches of the ordinary form, which enter safely into the substance of the brain.

Having thus described, to a certain extent, the system of vessels by which the blood is conveyed *from* the heart to the various organs of the body; we have now to consider the vessels by which it is conveyed *back* to that organ—these are the veins. Before describing them, however, there is an intermediate class of vessels to be noticed, which possess some striking and remarkable peculiarities—they are termed the capillaries.

The capillaries are the extreme ends of the arteries and veins. They are called capillaries, because they are supposed to be as small as a human hair; but, in point of fact, they are infinitely smaller. They are generally described as a distinct system of vessels, although they are known to be merely the fine terminations of the arteries, and beginnings of the veins; because, as I have stated, they possess certain peculiarities that do not belong to either arteries or veins. They are the vessels that connect the two systems. An artery, as it proceeds from the heart, becomes gradually smaller, decreasing in size until it becomes so small, that it loses its characteristics of an artery, and is then termed a capillary vessel. This vessel, after proceeding some distance, gradually increases in size till

we find it at the commencement of a very small vein, which, as it approaches the heart, unlike the artery, continues to become larger, and, uniting with other veins, at last forms the great vena cava, which forces all the blood of the body into the right auricle. In the passage of the vital fluid through the capillaries, a great change occurs in its properties. It loses much of its vitality, and, at the same time, the bright-red colour it had in the arteries, which is changed to a purple hue, as we see in the veins when they are swollen. The under part of the wrist, when the hand is warm, and held down the side of the body for a few moments, exhibits most beautifully the colour of the veins, and is, indeed, quite a picture to contemplate, as far, at least, as regards a beautiful variety of colours.

The capillaries exercise a considerable influence on the circulation. Though so exceedingly small, their muscular coat is very strong, much stronger, indeed, in comparison, than the same coat on the arteries; and, by its means, they can retard or accelerate the passage of the blood through them to a surprising extent. They are strongly influenced by the emotions of the mind, and often afford us the means of knowing something of "that within which passeth show." Thus, for instance, when the mind is under the influence of extreme terror, these vessels almost stop the circulation. We see the effect in the countenance, which then becomes of an ashy paleness, and the hue of health flies from the cheek the moment its cause—the unceasing circulation of a stream of blood in these small vessels—is interfered with. Again, under the influence of sudden joy, the capillaries expand, and allow a quicker and more powerful current to pass through them than usual, making the eye beam with lustre, and giving to the whole countenance an expression of happiness that cannot be described. You are all aware, too, what an effect shame has upon these surprisingly minute, yet powerful vessels. They enlarge so suddenly, that the face becomes suffused with blushes, and its scarlet colour shows how powerfully the mind has acted upon the cause which has produced these appearances. The sudden flow of tears which follow certain passions of the mind, is, no doubt, likewise attributable to these capillaries; and they probably exercise a far greater influence on the circulation than is generally imagined. They produce one curious effect which, no doubt, was the cause of the circulation remaining undiscovered for so great a length of time. They empty the arteries of all the blood they contain after death; so that in the dead body no blood is found in the arteries, but all in the veins. This led the ancients to believe, that the arteries were always empty of blood, and imagine that they were only for the purpose of conveying a certain ethereal fluid, which they called the vital spirits—to the different organs.

The veins are the vessels which, commencing at the capillaries, return the blood back to the heart. They do not possess a muscular coat, like the arteries, and, therefore, they have no pulse like those vessels; but in order to facilitate the passage of their contents, they are furnished with numerous valves, which prevent the blood returning when it has been pressed forward. The heart, as I shall presently show you, has no influence on the passage of the blood in the veins, as its force is lost in the capillaries; but as they are much pressed upon by the muscles of the body, every kind of action assists in propelling their contents forward. From this circumstance it is, that exercise is so necessary and so important; for in persons who use much exertion, as in walking or riding, for instance, there is a quicker and more powerful circulation than in those who take no such exercise; and the body is consequently much better supplied with the source of health and vitality in persons of active, than in those of sedentary habits.

Let us now pause for a moment, and see how far we understand the organs of the circulation. First, then, I have described to you the necessity for some organ capable of forcing the blood from some given point in the body to its various parts, such as we find in the heart. I have pointed out to you the situation and form of this organ, the various chambers of which it is composed, the manner in which it is excited to action, and the purpose it fulfils. Then we mentioned the principal facts to be noticed in connexion with the vessels conveying the blood away from the heart—the arteries; the different coats of which they were composed, the various uses they performed, and the protection afforded to preserve them from injury; at the same time, the manner in which they were distributed to the different organs, and the effect produced by the difference in distribution demanded our attention; and, lastly, we considered the peculiar features which distinguish the vessels which assist in returning the blood to the heart, their dependence on the emotions of the mind, and in the veins, the reason why excerise is of such benefit and importance.

Thus far, then, I have described all that it might appear necessary to know, in order to understand the circulation of the blood. The great discoverer of the circulation, the illustrious Harvey, thought that it was by the action of the heart alone that it was accomplished ; but subsequent discoveries have shown that this cannot be the case. Although the left ventricle of the heart is an organ of great power, it is not sufficient of itself to cause the blood to perform a complete circuit, and there are various assisting causes that co-operate to produce this effect. That the heart alone is not the moving cause, may be proved by several striking facts ; but the following may suffice, because it is conclusive :—If we tie an artery, it will be found that the blood in the part beyond where it is tied, and which consequently cannot experience any effect from the contraction of the heart, will yet proceed onwards in its course ; and if a vein be tied, the portion of it between the heart and the place where it is tied, will be emptied of its contents, although the blood in this case is of course relieved from any upward pressure of the returning current. These facts of themselves satisfactorily prove, that the heart alone is not the prime mover ; but it will be rendered yet more evident, if we consider that the blood in the course of its circulation, passes through a series of capillary vessels, where it is quite impossible the heart's power can be felt to any extent. It was mentioned, when describing the means adopted to prevent the blood having too great a force on its entrance to the brain, that the means adopted were the subdivision of the arteries into numerous capillaries. Now the same effect must be produced in both cases ; the force of the blood is diminished, and it is unreasonable to suppose, that in the case of the body it still possesses sufficient impetus to force its way upwards to the heart. Some physiologists have supposed the right auricle to possess what they termed a suction power, by which it drew into it the ascending blood ; but this cannot be the case ; for if we take a flexible tube, like one of the veins, and attempt to suck up any fluid through it, we shall find, that after a very small quantity has been drawn up, the sides will be pressed together in consequence of a vacuum having been formed, and no exertion will enable us to draw up any farther quantity.

The power of the heart is quite sufficient to account for the passage of the blood to the capillaries, and it is much greater than we might imagine. Smith says, that from experiments carefully made and frequently repeated, it is believed that the left ventricle projects its blood into the aorta with a velocity equal to twenty-one feet in the minute. Dr. Haller states, that the internal area of the left ventricle of the heart is equal to fifteen square inches ; these multiplied into seven feet and a half (the height to which he calculates by experiment on animals, that the blood would rise in man above the level of the heart) give 1350 cubic inches of blood, which press upon that ventricle when it first begins to contract—a weight equal to 51—5 pounds. Supposing that the quantity of blood taken into the heart during each dilatation be two ounces and a half, that the heart contracts seventy-five times in a minute, and that thirty pounds represent the quantity of blood circulated in the body of a moderately-sized man, the whole mass will pass through the heart twenty-three times every hour, and an entire circulation will be performed every three minutes. The passage of the blood in point of rapidity is not, however, equal throughout its course. If we place one knee over another while sitting down, we shall observe that the foot will be raised every time the heart pulsates ; and if we consider how great a weight this is to raise, merely by the tendency of the blood to continue in a direct course, in consequence of its inertia ; we shall see that the force of this current of blood must be very considerable. The blood has two complete and distinct circulations to perform:—First through the lungs, in order to have the impurities it has contracted removed, by being brought into contact with the air ; and, secondly, through the body, in order to supply every organ with vitality and nourishment. The means by which this is really effected, so far as the heart's action is concerned, has been clearly, and, I think, satisfactorily described by Dr. Southwood Smith, in his treatise forming part of the "Library of Useful Knowledge." "The heart is a hollow muscle, possessing both elastic and contractile powers. Its contractility depends on the muscular fibres, of which it is principally composed ; its elasticity on the cellular tissue, which, as we have seen, is mixed up with the muscular. Its elasticity is inferior to its contractility ; but its elasticity is indispensable. When the heart contracts, its muscular fibres have not only to expel the blood, but to overcome the elasticity which would prevent contraction ; and when it dilates, the muscular fibres relax, and allow its elasticity to operate. The one is a vital, the other a mechanical

agent. Power is created by the action of contractility, but elasticity merely restores a part to its primitive condition, when the constraining force has ceased to operate.

The cause of the heart's contraction is the entrance of the blood into its cavities; the cause of the heart's dilatation is the action of its elasticity when its contractility has ceased. In this manner may be explained what have been called the *systole*, or contraction, and the *diastole*, or dilatation of this organ. The elastic power facilitates the reception of the blood into the heart; the contractile power effects its departure from it. The elastic power opens the auricle; the contractile power closes the ventricle. When the contents of the auricle have been expelled, as soon as the contractile power has so relaxed as to give the elastic power the superiority, dilatation commences, and proceeds until the walls of the auricle have resumed their natural state. A vacuum is, therefore, formed within the auricle, and the blood which is urged forwards to the heart along the veins, is invited by this vacuum into the auricle. Elasticity and contractility are, then, two great powers by which the heart acts.

Supposing that the quantity of blood taken into the heart during each dilatation be two ounces and a half, that the heart contracts seventy-five times in a minute, and that thirty pounds represent the quantity of blood circulating in the body of a moderately-sized man, the whole mass of blood will pass through the heart twenty-three times every hour, and an entire circulation will be performed every three minutes. The time spent during one circulation may thus be easily ascertained; but it is more difficult to discover how far the action of the heart extends along the arteries, and at what rate the blood travels in different stages of its journey."

With these remarks I may conclude the lecture. I intended to have said a few words on the proofs of the circulation, and the circumstances attending its discovery; but I have probably engaged you long enough for the present. I trust, however, that the subject has been interesting, and that I have proved the statement with which I commenced, namely, that there was nothing in it that could be in any way unpleasing; but, on the contrary, it engaged the mind in contemplating contrivances the most beautiful that can be conceived, and suggested reflections of the greatest moment and importance to us all. Under the impression that you may probably desire to pursue the subject farther, I shall take the liberty of naming a few popular works, with which I think you will not fail to be pleased. First, I would recommend Dr. Southwood Smith's "Philosophy of Health," and his "Treatise on Animal Physiology" in the "Library of Useful Knowledge." Mr. Lord's work, "Popular Physiology," published by the Society for the Promotion of Christian Knowledge, is also a useful book; and Dr. Andrew Coombe's Treatises on "The Principles of Physiology applied to the Preservation of Health and on Digestion," having been written expressly for popular use, will likewise be acceptable. In addition to these, I would likewise particularly recommend the perusal of "Paley's Natural Theology," a pleasing work of instruction, and containing profound reflections on the knowledge that may be gained from the books previously mentioned.

ON THE METALS.

(From Hope's "Practical Chemist.")

GENERAL PROPERTIES OF METALS.

Metals are distinguished from all other bodies by the following properties:—

1. They are all conductors of heat and electricity.
2. They are quite opaque, though reduced to very thin leaves.*
3. They are good reflectors of light, exhibiting a peculiar appearance, called the metallic lustre.
4. When combinations of these, with any of the preceding elements, are subjected to the action of the galvanic battery, the metals are separated at the negative pole of the battery. Every substance possessing these properties is regarded as a metal.

The number of metals recognised by chemists is forty-one.†

Some metals are malleable, or are capable of being hammered or rolled out into thin sheets or leaves, such as sheet iron, lead and copper, gold and silver leaf, and tin foil. Gold possesses this property in a higher degree than any other metal.

Some metals are *ductile*, or capable of being drawn into wires; for which gold, silver, iron, and copper, are remarkable.

The relative *weight* of the metals is very

* The greenish light seen when gold leaf is held before a candle, is supposed to be owing to the passage of the light through exceedingly small apertures in the metal.

† By some chemists, silicon is regarded as a metal, in which case the number would be forty-two.

different. Gold and platinum are more than nineteen times heavier than water, while potassium is so light as to float upon its surface.

Tenacity or strength. Iron is the most tenacious of all the metals; a wire about the size of a man's finger, will support a weight of 50,000 lbs.

Metals have considerable affinity for other bodies; hence they are rarely found *native* or pure. Silver, gold, platinum, copper, and a few others, are frequently found in a pure state, though most metals are obtained from the earth in the state of an *ore*, which generally consists of the metal combined with oxygen or sulphur, forming an *oxide* or *sulphuret*. The most usual method of separation of the metal from the oxygen, or sulphur, consists in heating the ore, either in open air, or in contact with charcoal, which separates the impurities, and exhibits the metal in a pure state. This process is called the *reduction* of the metal.

The metals unite with each other, and form a class of compounds called *alloys*, which are exceedingly useful in the arts. Brass is an alloy of copper and zinc; pewter, of tin and lead; and bell metal an alloy of copper and tin, or of copper, tin, and zinc.

Amalgams are combinations of the metals with quicksilver. Some of these are very useful in the arts: thus, an amalgam of quicksilver and tin is used to cover the backs of looking-glasses; and of quicksilver and gold, for gilding buttons and various other articles.

The classification of metals which will be adopted in this work, is founded, in part, on the nature of their oxides, and in part on their practical applications. The first two chapters are founded on the first principle, and the last three on the latter.

The metals will be divided into five classes, the first of which includes those metals whose oxides have alkaline properties, and are hence denominated alkaline metals; the second, those whose oxides form earths, and which will be called earthy metals; the third includes the cheaper and more common kinds of those metals that are used in the arts; the fourth, the more perfect metals of the same kind, and which are generally of great value; the fifth class includes those metals that have not yet been applied to the purposes of art.

ALKALINE METALS, AND THEIR COMBINATIONS WITH THE PRECEDING BODIES.

Potassium, Sodium, Lithium, Barium, Strontium, Calcium, and Magnesium.

*Potassium.**—Potassium was discovered by Sir Humphrey Davy in 1807, by placing a piece of pure potash between the poles of a powerful galvanic battery. A large quantity of oxygen was liberated at the positive pole, and globules of high metallic lustre, resembling quicksilver, appeared at the negative. The metal obtained in this manner was in very small quantities; but another method was soon adopted by Messrs. Gay Lussac and Thenard, of France, by which they obtained it in much greater quantities, by heating iron turnings in contact with pure potash, which is an oxide of the metal.

Properties.—Potassium is a white metal, resembling quicksilver, having the whiteness of tin; it is so soft that it may readily be kneaded with the fingers, and is considerably lighter than water. With a fresh surface it has strong metallic lustre, but is instantly tarnished by exposure to air, exhibiting at first a bluish cast, like that of a recently-cut surface of lead, and is afterwards covered with a white crust, which is pure potash.

Potassium has a powerful affinity for oxygen, and will take it from any other compound that contains it.

Illust.—When thrown upon water it decomposes that liquid, moving over its surface with rapidity, and combining with both its constituents with the phenomenon of combustion, accompanied by a beautiful rose-coloured flame. The oxygen of the water combines with a part of the metal, forming an oxide (potash) which is dissolved in the water, while the hydrogen takes up another portion of the metal, forming a gaseous compound called *potassiuretted hydrogen*, which inflames spontaneously when it comes in contact with the air, and burns with a rose-coloured flame as before mentioned.

Oxides of Potassium.—There are two combinations of potassium with oxygen, the *protoxide* or potassa, which is composed of 1 atom of each ingredient, and the peroxide, composed of 1 atom metal to 3 of oxygen.

POTASSA.—*Potash.*—48.

Potassa is a white crystalline solid, and is only obtained in a state of purity by

* The figures after the names of metals in the titles, represent their combining number, or equivalent.

burning the metal in oxygen gas or in air; but for ordinary purposes it is procured from woodashes, which contain the potassa in combination with carbonic acid; which last being separated, the potassa is left pure, with the exception of containing 1 atom of water, which cannot be removed short of reducing the potassium to a metallic state. The article, therefore, as thus obtained, is properly called a *hydrate* of potassa. When exposed to the air, it absorbs water from it, and becomes liquid; this property is called *deliquescence.*

Obs.—The name of potassa is now generally applied to the pure article and to the hydrate, while the term *potash* is retained for that which is procured by boiling to dryness the ley obtained by *leeching* or lixivating woodashes, and is frequently called common or crude potash. It was formerly called vegetable alkali. The name potash was given because the ley was boiled down in pots.

Potassa is called alkali, as it changes vegetable blues to green. It is called fixed alkali to distinguish it from ammonia, which is called volatile alkali. It combines with acids, forming salts. Pearlash is, in chemical language, carbonate of potassa.

SODIUM—24.

Sodium is the metallic base of common salt, and was discovered by Sir Humphrey Davy, a few days after his discovery of potassium, and by means of the same instrument. The experiment was in all respects performed in the same manner, except that the alkali soda was substituted for potassa.

Sodium may be obtained from soda, charcoal, and iron turnings, in the same manner as potassium. Thirteen ounces of soda yield about one ounce of the metal.

Sodium is a white metal resembling potassium. It is a little heavier than that metal, but light enough to float on water, and moves about upon its surface with a hissing noise, and rapidly combines with its constituents, forming soda and sodiuretted hydrogen.

Illust. When sodium is thrown upon water, its oxygen combines with a part of the metal, forming soda, which is dissolved in the liquid, its hydrogen, at the same time, taking up another portion of the metal, forms a gaseous compound, analogous to potassiuretted hydrogen; the proper name of this new compound is *sodiuretted hydrogen.*

Sodium fuses at 200 degrees, and is vapourized at a white heat; it is so soft that it may be easily pressed out into leaves by means of a knife. It is immediately tarnished on exposure to the air, from the combination with its oxygen; but is not so rapidly oxydized as potassium.

When a small piece of sodium is placed upon clean quicksilver, it soon begins to move if the surface be moistened, as by breathing on it; the motion is somewhat irregular, but generally circular, and the whole surface of the quicksilver becomes agitated, presenting a very singular appearance. If a small piece of sodium be brought in contact with a globule of quicksilver, and the two be pressed together, as with a clean pair of forceps, or the blade of a knife, they will unite by a kind of explosion, and the steel knife or forceps will be amalgamated.

Sodium combines with oxygen in two proportions, forming two oxides. The first, or *protoxide*, is more generally called *soda;* it is also called one of the mineral alkalies, and is composed of 1 atom of sodium and 1 of oxygen. *Peroxide* of sodium is a yellowish solid, composed of 2 atoms of sodium to 3 of oxygen, and is formed when the metal is burnt in pure oxygen gas.

SODA—32.

Soda is a greyish-white solid, and is formed when the metal is burnt in oxygen or air; it is also formed when the metal is thrown upon water, by uniting with its oxygen; but in whatever way procured, except by uniting the metal with dry oxygen, it retains a portion of water which cannot be separated by any means hitherto employed. It is therefore called *hydrate* of soda.

Soda is extensively used in the arts. It is sometimes called the *mineral alkali.* It is very soluble in water, absorbs water from the air, or *deliquesces.* It changes vegetable blues to green.

Soda was formerly prepared from the ashes of seaweed, which is called *kelp*, or from those of plants growing in the vicinity of the sea (called *barilla*). More recently it has been prepared by the decomposition of Glauber's salt, mixed with sawdust at a high heat.

Soda is extensively used in soap making, and constitutes the base of all hard soaps, while potash forms the base of soft soaps. The Castile soap is made of soda and sweet oil. Common brown bar soap is made of a mixture of potash and soda with tallow, and contains much rosin. That which has a marbled or mottled appearance derives it from the copperas or iron rust used, both of which injure the article. Transparent soaps, used extensively for the toilet, are prepared by dis-

solving the soap in spirits of wine, by means of heat, and as the liquid cools, a transparent and solid cake is formed at the bottom. The soaps are scented by adding essential oils before they become solid.

Sodium combines with chlorine, forming a *chloride* of sodium; this is the well-known article, common salt.

Sodium combines with hydrogen, and forms *sodiuretted hydrogen*. This compound is formed in great abundance in the experiment for obtaining sodium, and when sodium is oxydized by means of water.

Properties. Sodiuretted hydrogen is a colourless gas, slightly absorbed by water. It is a non-supporter of combustion; it is very inflammable, burning with a brilliant yellow flame, in air or in oxygen, producing soda and water. The gas is decomposed in a few hours by standing over water or quicksilver. When standing over water, 30 measures of the gas are reduced to 29, producing pure hydrogen and soda, which last is dissolved in the liquid. When confined over quicksilver, an amalgam of sodium and pure hydrogen are the products.

LITHIUM—10.

Lithium is the metallic base of the alkali called *lithia*, discovered in 1818, and is contained in some minerals, such as some varieties of mica or mineral isinglass. Lithia is an alkali, composed of 10 parts, or 1 atom of lithium, and 8, or 1 atom of oxygen.

BARIUM—69.

Barium is a white metal, somewhat resembling cast iron, and is the metallic base of the alkaline earth, called *barytes*, *baryta*. It was discovered by Sir Humphrey Davy in 1807.

Baryta is an oxide of Barium, and composed of 1 atom of each element. It is a white solid, possessing alkaline properties, and when water is poured on it, slakes like common quicklime, giving out considerable heat. It combines with acids, forming salts.

STRONTIUM—44.

Strontium is the metallic base which forms, by its union with oxygen, an alkaline mineral called *strontia;* this received its name from Strontian, a small village in Scotland, where it was discovered in a lead mine. This mineral is also found on an island in Lake Erie, called Strontian Island. Strontia gives a blood-red colour to spirits of wine, whence it is used in theatrical representations to exhibit the red lights required on such occasions.

Exp. Pulverize some nitrate of strontia, and thoroughly moisten it with alcohol; place it on a tile or brick and set fire to it; the alcohol will be tinged of a blood-red.

CALCIUM—20.

Calcium is the name given to the metallic base of lime. It is a white metal like silver, and was discovered by Sir Humphrey Davy in 1807; though lime, which is an oxide of this metal, has been known from the remotest ages.

LIME—28.

Lime is composed of 1 atom of calcium united to 1 of oxygen; its equivalent is therefore $(20 + 8)$ 28.

Lime is a greyish-white, brittle, earthy solid, the specific gravity of which is about 2.3. It is called *quicklime*, formerly *calcareous earth*.

Lime is never found native, but is generally combined with some acid, and that is most frequently the carbonic. The limestone, so common in the form of marble quarries and chalk hills (as in England) are all a carbonate of lime, from which lime is prepared by heat.

Illust. Lime is prepared by heating marble or common limestone to redness in kilns, by which process the carbonic acid is expelled and quicklime is left.

Lime has a great affinity for water, and the combination is attended with the production of much heat, and a formation of a white bulky powder called the *hydrate* of lime, and is composed of 1 equivalent of lime and 1 of water. This process is called *slakeing* of lime, and the substance itself is called *slaked* lime.

Obs. 1. The heat given out, where large quantities of lime are slaked at once, is sufficient to set fire to tinder, and in some instances light has been seen. The heat produced is owing to the condensation of the water to the solid state. Lime exposed to the air, soon absorbs sufficient moisture to form a hydrate; it is then said to be *air slaked.* If we continue to add more water to lime that has been slaked, a thick cream-like liquid is formed, called *cream of lime,* which is used for white-washing the walls of buildings. By far the largest proportion of lime is used for mortar, in laying brick and stone for building.

2. Chalk and marble are carbonates of lime; plaster of Paris, or gypsum, is the sulphate; and animal bones are a mix-

ture of the phosphate and carbonate of lime.

CHLORIDE OF LIME.

This compound, known under the name of *bleaching powder*, or chloride of lime, is prepared by exposing recently slaked lime, on stone shelves in a close room, to the action of chlorine gas. Large quantities of the gas combine directly with the lime.

Chloride of lime is a dry white powder, having a faint odour of chlorine, and an acrid and disagreeable taste; it partially dissolves in water, and has powerful bleaching properties.

Obs. 1. Nearly all the bleached cotton and linen goods are prepared by the chloride of lime. The goods are first cleansed by washing them out in hot pearlash water, to remove all dirt and grease, and then immersed in a solution of the chloride, and afterwards washed in more pearlash water. Both of these processes are repeated until the goods become sufficiently white, when they are boiled in a diluted solution of pearlash and white soap, which removes all odour of chlorine, and gives to the articles a clear and beautiful whiteness.

2. Chloride of lime is also used for the purpose of disinfection when contagious diseases prevail. It is considerably used in medicine.

Exp. 1. To a solution of indigo dissolved in sulphuric acid, pour in a solution of chloride of lime, the colour will disappear.

2. Repeat the same experiment with solution of blue cabbage.

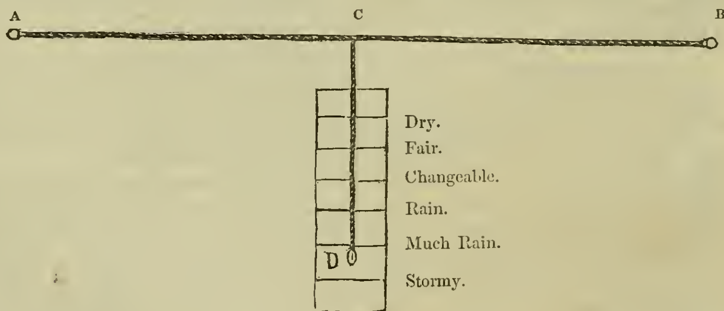
3. Take a piece of blue cotton goods, and immerse it in a boiling solution of chloride of lime, the colour will disappear.

4. Shave off exceedingly thin films of the unbleached bees-wax, and throw them into the solution of chloride of lime —they will be bleached in a few minutes.

SIMPLE METHOD OF MAKING A BAROMETER OR HYGROMETER.

TAKE a piece of whipcord, about two feet long, and steep it in a strong solution of salt; then tie a knot at each end, and on two nails, A and B, fix the same to any wall; if an outside one, the better. From centre, C, suspend, by a silken thread, a leaden plummet, about the thickness of a tobacco-pipe, and an inch long; then affix a piece of card paper against the wall, marking thereon the highest and lowest range of the plummet for very dry and stormy, and the intermediate spaces into degrees. A hygrometer of this kind will be found to correspond with the rise and fall of the mercurial barometer.

S. RUTTER.



REVIEW.

The People's Letter-bag, and Penny Postage Act Companion; containing Forms of Letters written on every-day subjects, and adapted to the use of the Million. By WILLIAM WAVERTON. Darton and Clark.

WHOEVER for the small charge of one shilling drops his hand into the "People's Letter-bag," may draw letters upon every variety of subject, so as to put it out of the power of either man, woman, or child, who can use his pen, to plead as an excuse for not communicating with absent friends, that they "do not know what to write." We cordially recommend it to everyone who may be at a loss to express his ideas.

SOLUTION OF PROBLEM.

To the Editor of the Mechanic and Chemist.

SIR,—May I beg you to insert in your valuable miscellany, the following solution of the problem proposed in No. 68.

$$\text{Given } (x+1)\,.\,(x^2+1)\,.\,(x^3+1)=30\,x^3.$$

$$\text{Multiplying, we have } x^6+x^5+x^4-28\,x^3+x^2+x+1=0;$$

$$\text{And this is divisible into factors } x^2-3\,x+1=0.$$

The first solved gives $x=(3\pm\sqrt{5})\div 2$. The latter is also solvable by quadratics, for it is equal to $(x+1)^4=-6\,x^2$; or, $(x+1)^2\pm x\sqrt{(-6)}$.

$$\text{Hence } x=\pm\sqrt{(-6-2)}\pm\sqrt{(-6\pm 4\sqrt{-6})}.$$

I remain yours respectfully,

J. YATES,
8th Batt. Roy. Artil.

ANOTHER SOLUTION OF THE CLOCK QUESTION.

PUT $x=$ the number of minute spaces traversed by the hour hand; then $12\,x=$ ditto passed over by the minute hand. Then by the question,

$x+15=12\,x$; or, $11\,x=15\;\therefore x=1\frac{4}{11}$ min. $=1$ min. $21\frac{9}{11}$ sec. for the position of the minute hands.

W. W.

[With unaffected deference to our much-esteemed correspondent, we cannot admit this as "another solution" of the question, but consider it identical in principle with the third method we suggested, i. e., the same conclusions are obtained from the same data; but for *obvious reasons* we avoided even the *appearance* of abstruseness in our explanation.—ED.]

HYDROSTATICAL QUESTION.

SIR,—I have worked out my former question as follows:—
$8^3\times .5236=268.0832$ cubic inches in the ball, divided by $2=134.0416$ cubic inches to be immersed.

Then $134.0416\times .578$, weight of a cubic inch of water $=77.4760448$ ounces, weight of water displaced, or the weight of the copper ball; which divide by 5.159, the weight of a cubic inch of copper $=15.0176$ cubic inches of copper in the ball.

Again, $8^2\times .7854\times 4=202.0624$ square inches the superficies of the ball; and 15.0176 divided by $202.0624=.0743$ inches, the required thickness of the copper.

A. D. M.

MECHANICAL AND CHEMICAL SOCIETY.

IT is particularly requested, that all persons residing in London, willing to join, or help in the formation of a "London Mechanical and Chemical Society," will forward their addresses by post to "TYRO CHEMICUS," Essex and Temple Coffee-house, 43, Essex Street, Strand, where they will meet with immediate attention; and if sufficient, a meeting will be called, and other preliminaries arranged, relative to the immediate establishment of the Society. No letters will be taken in unless post paid. Communicating as early as possible will oblige

TYRO CHEMICUS.

Feb. 4, 1840.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Feb. 19, R. H. Semple, Esq., on the Alkalies. Friday, Feb. 21, H. Brown, on the Spirit of Burlesque, as exhibited in English Literature. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 20, N. F. Zaba, Esq., on the History of Poland. At half-past eight.

Poplar Institution, East India Road.—Tuesday, Feb. 18, R. O. Ogilvie, Esq., on Electricity. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, Feb. 18, Henry Althans, Esq., on Mental Discipline. At eight o'clock.

QUERIES.

A cheap plan for making either a theodolite, or a quadrant? LOGARITHON.

How to make bath bricks for cleaning knives &c, and what they are composed of?
J. H. H.

Suppose a large capitalist lends a sum of 1000*l*, upon the terms that it shall be returned within 52 weeks, by equal weekly instalments, and that *upon advancing* the 1000*l*, he deducts the 52 weeks' interest at five per cent (50*l*); this 50*l*, he lends again to another party upon precisely similar terms, and also lends upon the same termst he weekly instalments of the 950*l* remainder of the 1000 as they come in; and so on; lending always the sums produced by the interest retained, and the weekly instalments as they come in *to other parties*, upon the exact terms, upon which *the original borrowers* had them. The question is, how much profit would the capitalist derive *yearly*, from his 1000*l*; supposing there to be no bad debts, and that the money was always invested? GAMMA.

ANSWERS TO QUERIES.

To make Fulminating Silver.—"R. H. H." Dissolve pure silver in nitric acid, and precipitate the silver by lime-water; put the precipitate upon filtering paper, and when dry, put it into a shallow vessel (it is better not to remove it from the filtering paper); then pour liquid ammonia upon it, and when it has stood a few hours, pour off the liquid, and a black powder remains, which must be carefully set in a proper place to dry. It is better to dilute the solution of silver, and add the lime-water as long as any precipitate is thrown down. This is the mode of making fulminating silver. A very little friction or a gentle heat causes a violent explosion. It must not be put into bottles, but left in the vessel in which it is made; care being taken not to operate upon any quantity. The compound that is generally used, and which will answer all the purposes of "R. H. H," is called detonating silver, and is thus prepared;—Dissolve 60 grains of silver in ½oz. of nitric acid, adding 2 ounces of spirits of wine. The solution must be heated till it begins to boil; a copious precipitate is obtained, which, when washed and dried, is ready for use. It explodes by heat, a blow, or long continued friction, but not by pressure. Fulminating mercury answers most of the purposes of fulminating silver; but it is not so powerful, and will bear a greater friction without detonating, and the report is about the same as that of silver. It is prepared thus:—Take 100 hundred grains of mercury, and dissolve it in a measured 1½oz. of nitric acid with heat; when cold pour upon it 2 measured ounces of alcohol, and apply heat till effervescence is produced; a white fume will then begin to appear on the surface of the liquor, and a powder will be gradually precipitated. Collect on a filter, wash and dry it cautiously. FELIX WEISS.

TO CORRESPONDENTS.

Frederick Clark.—*We feel great pleasure in observing the progress of the Mechanical and Chemical Society proposed by "Tyro Chemicus," and we confidently predict brilliant success to the united exertions of our worthy friends. The handsome and liberal offer contained in the following letter, will, we trust, be doubly prized; it will be valued for the accommodation itself, and more especially for the alliance of the writer:—*

To the Editor of the Mechanic and Chemist.

Sir,—I am desirous of becoming a member of the Society about to be formed by "Tyro Chemicus;" and as I think there would be more societies formed, were it not for the want of meeting places unattended with expense, as is the case with coffee-houses, &c., I beg to offer "Tyro Chemicus" and his friends (if not already suited) the use of a room to hold their meetings, until such time as the Society can make arrangements, to have a more convenient one of their own.

I remain, Sir, your obedient servant,
FREDRICK CLARK.
37, Sussex Street, Tottenham Court Road.

Sigma.—*We shall be glad to receive the papers he proposes to send.*

S. K.—*To make looking-glass, the quicksilver must be spread on the tin foil, and a piece of writing-paper placed upon the silvered surface; then apply the glass, and draw out the paper, pressing at the same time upon the glass. The whole process should be as rapidly performed as possible, and a weight placed on the glass till the silver appears fixed, that is, till the process of amalgamation is finished. The method of cleaning and polishing shells was described in a recent member of "The Mechanic."*

C. S. *would greatly oblige "Felix Weiss," by sending him a letter, stating the price and dimensions of his microscope. Direct,* 53, *Pembroke Place, Liverpool.*

J. B.—*The number of vibrations which a pendulum makes in a given time, varies as the square-root of its length. The length of a pendulum which vibrates seconds in this latitude, is* 39.2 *inches; and, consequently, the length of a pendulum which vibrates half seconds, or* 120 *times in a minute, is* ¼ *of* 39.2, *or* 9.8 *inches, and a pendulum vibrating double seconds, or* 30 *times in a minute, is four times* 39.2, *or* 156.8 *inches.*

M. T. N. *proposes a mode of conveying letters to different parts of the metropolis by means of locomotive engines running in tunnels; the advantages derived from such a scheme would not be commensurate with the enormous expense it would occasion. A similar plan was in contemplation some years ago, but intended for the conveyance of gas, water, sewers, &c., as well as for passengers; it was, however, abandoned for the reason above stated.*

S. Walter *in our next, if possible.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

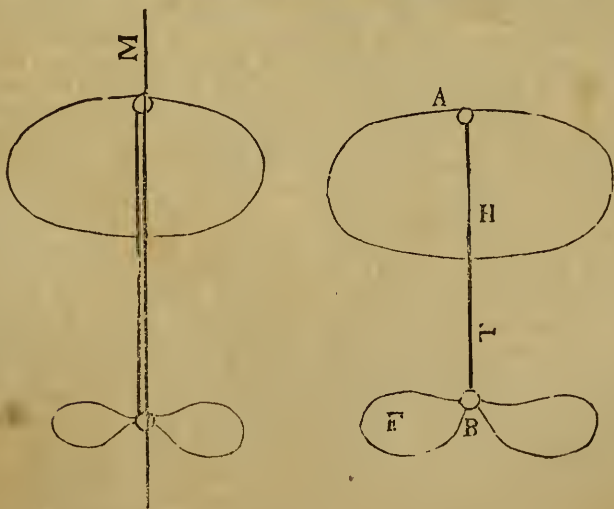
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 78, NEW SERIES. | SATURDAY, FEB. 22, 1840. PRICE ONE PENNY. | No. 199, OLD SERIES.

HODGE'S FIRE-ESCAPE.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

HODGE'S FIRE-ESCAPE.

(See Engraving, front page.)

This simple and cheap contrivance consists of a few pieces of cordage. The first piece, called the main-supporter, should be in thickness from three-fourths of an inch to one inch in diameter, a bulk sufficiently great to bear the weight of anyone; and as to its length, that will depend upon the height of the lodger's room, where the rope is to be securely fastened to one end of a bedstead, coiled up, and examined occasionally, to see that the fastenings, as well as cordage, are both in a secure state.

The next piece, called the shoulder-holder, must be in proportion with the body it is to surround; say half an inch in diameter, but something more for a heavy person; and from four feet and a half to six feet in length, with an eye in the midst, to slide over the main supporter.

The third piece, called the feet-holder, has also an eye to slide; but that piece is divided into two parts, in order that both feet may be supported; and one or the other, risen up occasionally to expedite the journey downwards. As to the fourth piece, called the tye, it is designed to keep the shoulder and feet-holders together, by fastening the ends to both eyes, as A and B; a view without the main-supporter.

Thus, all appendages being fixed upon the main-supporter, fastened securely, and coiled up, the shoulder-holder is then to be first thrown over the body, before throwing the remainder of the rope out of a window; and, after getting out, place the feet in their holders, which being done, the act of sliding downwards may be gradually or hastily performed, by keeping the eye of the shoulder-piece more or less horizontally, and moving one foot or the other upwards, to do the like with the eye of the feet-holder; which, I think, would be most proper if manufactured of iron, and wound over with a string, after first fixing both ends of the cord around the hollow of the iron eye.

Some farther reservation seems, however, wanting for the aged and weak; such as surrounding the shoulder-holder as far as the armpits with wool, cotton, or something else of a soft nature, to hinder the rope from grating the skin. A string for drawing both sides together, as an additional security in keeping the rope under the armpits, may also be added; and although it is certain that the act of sliding can be performed gradually, a pair of gloves for tender hands cannot be amiss.

As throwing over the shoulder-piece, getting out of the window, and sliding down, may be all performed in four or five minutes, the rope could then be soon returned to another person in the same room, in the event that the progress of the flames shall not have advanced so far as to hinder a retreat; and for this reason I would advise, that a variety of fire-escapes may be manufactured with two and even three pairs of holders on one main-supporter; so that that person who is to descend first, will have to use the last holder, or that one farthest removed from the first point of safety; and supposing that the flames shall destroy that point, there will then be only the farther expense of splicing a piece; but if the main-supporter shall be designed for a second or third floor, it could then be exchanged, at a very trifling loss, for another to suit the original height.

ADVICE TO TRAVELLERS.

(From a very clever and amusing Work, " The Letter-bag of the Great Western.")

" Call steward, inquire the number of your cabin; he will tell you No. 1, perhaps. Ah, very true, steward; here is half a sovereign to begin with; don't forget *it is* No. 1. This is the beginning of the voyage; I shall not forget the end of it. He never does lose sight of No. 1, and you continue to be No. 1 ever after;—best dish at dinner, by accident, is always placed before you, best attendance behind you, and so on.—*I always do this.*

If you are to have a chum, take a young one, and you can have your own way by breaking him yourself.—*I always do.*

If the berths are over each other, let the young fellow climb, and do you take the lowest one; it is better he should break his neck than you.—*I always do.*

All the luggage not required for immediate use is marked ' below.' Don't mark yours at all, and you have it all in your own cabin, where you know where to find it when you want it. It is not then squeezed to death by a hundred tons of trunks. If you have not room in your cabin for it all, hint to your young chum he has too much baggage, and some of it must go ' below.'—*I always do.*

Never speak to a child, or you can't get clear of the nasty little lap-dog thing ever afterwards.—*I never do.*

Always judge your fellow-passengers to be the opposite of what they strive to appear to be. For instance, a military man

is not quarrelsome, for no man doubts his courage; a snob is. A clergyman is not over strait-laced, for his piety is not questioned; but a cheat is. A lawyer is not apt to be argumentative; but an actor is. A woman that is all smiles and graces is a vixen at heart; snakes fascinate. A stranger that is obsequious and over civil without apparent cause, is treacherous; cats that purr are apt to bite and scratch. Pride is one thing, assumption is another; the latter must always get the cold shoulder, for whoever shows it is no gentleman; men never affect to be what they are, but what they are not. The only man who really is what he appears to be, *is*—a gentleman.—*I always judge thus.*

Keep no money in your pockets; when your clothes are brushed in the morning, it is apt—ahem—to fall out.—*I never do.*

At table see what wine the captain drinks; it is not the worst.—*I always do.*

Never discuss religion or politics with those who hold opinions opposite to yours; they are subjects that heat in handling until they burn your fingers. Never talk learnedly on topics you know, it makes people afraid of you. Never talk on subjects you don't know, it makes people despise you. Never argue, no man is worth the trouble of convincing; and the better you reason, the more obstinate people become. Never pun on a man's words, it is as bad as spitting in his face; in short, whenever practicable, let others perform, and do you look on. A seat in the dress-circle is preferable to a part in the play.—*This is my rule.*

Be always civil, and no one will wish to be rude to you; be ceremonious, and people cannot if they would. Impertinence seldom honours you with a visit without an invitation—at least—*I always find it so.*

Never play at cards. Some people know too little for your temper, and others too much for your pocket.—*I never do.*"

CURIOUS ANCIENT RECEIPTS.

We present the following to our readers, rather as hints for future experiments, than methods to be practised exactly as described. Brass may be coloured to resemble gold, by immersing the articles in nitric acid for about one second, and then instantly plunging them in clean water; improved methods of producing some of the other effects may at present be known; but they appear on the whole to possess sufficient originality to attract the attention of the curious.

1. *To Harden Tin, and render it as Shining as Silver.*—Mix lead and tin with Greek pitch, and then take a lump of potter's clay, make a hole in it, and pour your mixture into it; then take of fine tin six or more ounces, and that being thoroughly melted, pour it on the mixture in the remaining space of the hole, before the mixture is cold; then leaving a hole in that, by thrusting an iron through it, pour in an ounce of mercury, which penetrating the whole mass, it will render the tin, when wrought and burnished, of the perfect lustre of silver; insomuch, that vessels made of it, will not by the eye be distinguishable the one from the other.

2. *To make Brass in colour resemble Gold.*—Bruise sal armoniac in a brass mortar into fine powder, mingle it with fasting spittle, till it becomes liquid, or like an ointment, and with this composition anoint your brass things; then hold them over a charcoal fire till the brass becomes pretty hot; then rub it over with whiting and bran well dried, and you will perceive it look like burnished gold, which will cause much admiration in those that know not what has been done unto it.

3. *To Clean Silver or other fine Metals.*—Take whiting and burned alum, mix them with the ashes of burned wheaten straw, and, when finely beaten, rub the plate, &c., with a woollen cloth well dried and heated against the fire, and your expectations will be curiously answered.

4. *To restore the Faded Colour in Cloth.*—Take woodashes, one part, quicklime, two parts, and put them into a lye made pretty strong with woodashes finely drawn off, and cleared from the settlings; then boil your cloth in a copper vessel with them, and rinse it out in warm water, wherein a lump of alum has been dissolved; press it, and it will look glossy, and of a fine new colour.

5. *To make Iron look as if Gilded with Gold.*—Burn an ounce of roch alum till it looks of a reddish colour, then take of sal armoniac an ounce, and of nitre half an ounce; beat them to a fine powder, and put them into boiling strong vinegar, in a brass pan, or other brass vessel, and when the liquor is a third part consumed, strain it well, and rub over smooth iron with it, and it will appear as if it were gilt with gold.

6. *A Varnish for Wood or Metal, representing a Golden Colour.*—Take two ounces of gum sandarac, one ounce of litharge of gold, and four ounces of clarified linseed oil; boil them in a glazed earthen vessel, till they look of a transparent yellow, and, varnishing your materials with it according to art, they will appear as gilded.

7. *To make Porcelain, a curious way.*—

Take the glaire of eggs, and calcined egg-shells finely beaten to powder; put these beaten together into gum-arabic water; let them stand a while over embers and thicken, so that they may be made into pastils; and when you have moulded them into proper forms for your purpose, dry and harden them in the sun, and the work is finished.

8. *To Whiten Copper quite through the body of the Metal.*—Take such copper as kettles are usually made of, tough and pliable, lay the plates in a crucible, and between everyone of them a strewing of white arsenic finely powdered, and being melted, when the smoke is over, the copper will be as white as tin.

9. *To Melt Amber.*—Mix strong vinegar with the juice of citrons, one part of the latter to two of the former; into this put the amber, and, being set over a slow fire, you will find the amber melt or grow soft, so that you may turn or mould it like soft wax.

10. *To Whiten Pearls.*—If they turn yellow or spotted, so that they become unsightly, losing their native lustre, burn tartar to ashes, and make a lye of it with spring water, wherein a little alum has been dissolved, and, putting in the pearls, let them seeth over a stove fire, and it will restore the pristine whiteness as orient as ever, and render them more durable and weighty, so, consequently, better for use.

11. *To Soften or Dissolve Horn of any kind.*—Burn the pods of beans well dried to ashes, and make a lye of them, then draw off the liquid part from the dross, and put a third part of strong vinegar to it; add quicklime and tartar; boil them over a good fire, putting in your planchets or pieces of horn, and it will soon be soft to work or mould into any fashion, and, if long boiled, become a jellied substance; but the cool air will harden it again.

12. *To Soften Ivory and Whiten it.*—Distil strong white-wine vinegar three times, and decoct red sage leaves in it, with a little quicklime; the ivory, being put in when the liquor is boiling hot, will soon become soft, and much whiter than it was; also this will take out yellow stains from ivory, &c.

13. *To break a Bar of Iron with ease.*—Daub the part you would break over with melted soap, then run a thread round it, and draw it backwards and forwards several times, that it may make a crease in a narrow circle; then dip a sponge in aqua fortis, and clap it round the crease fast bound, for six hours; so when taken off, a little stroke will make the bar break in the place where the crease was, though as thick as a man's arm, to the admiration of those that know not what you have done to it before.

14. *To restore the Faded Colour in Tapestry or Turkey Carpets.*—When you have beaten them, and with a hard brush cleansed them well with water in which bran hath been boiled, rub them over with fuller's earth, and let it lie thinly on, till well dried in the sun, and so do twice or thrice; and then being well cleansed from this by a thorough beating, brush them well over with alum water, and dry them in the shade, and so the faded colour will return almost as fresh as new.

HYDRAULIC LETTER-BALANCE.

(See Engraving opposite page.)

Description.—The stand, *a a*, furnished with two projecting rings, *b b*, to support the glass tubes, *c d*; *c* is a tube with mercury, to serve as a counterpoise; the tube, *d*, is closed at the lower end, and furnished with a wood cap, *e*, to receive letters.

This balance acts in the following manner:—When a weight is placed on *e*, the tube, *d*, sinks in the mercury, causing it to rise in proportion to the difference in the diameter of the two tubes, and to the weight employed. Farther explanation is unnecessary.

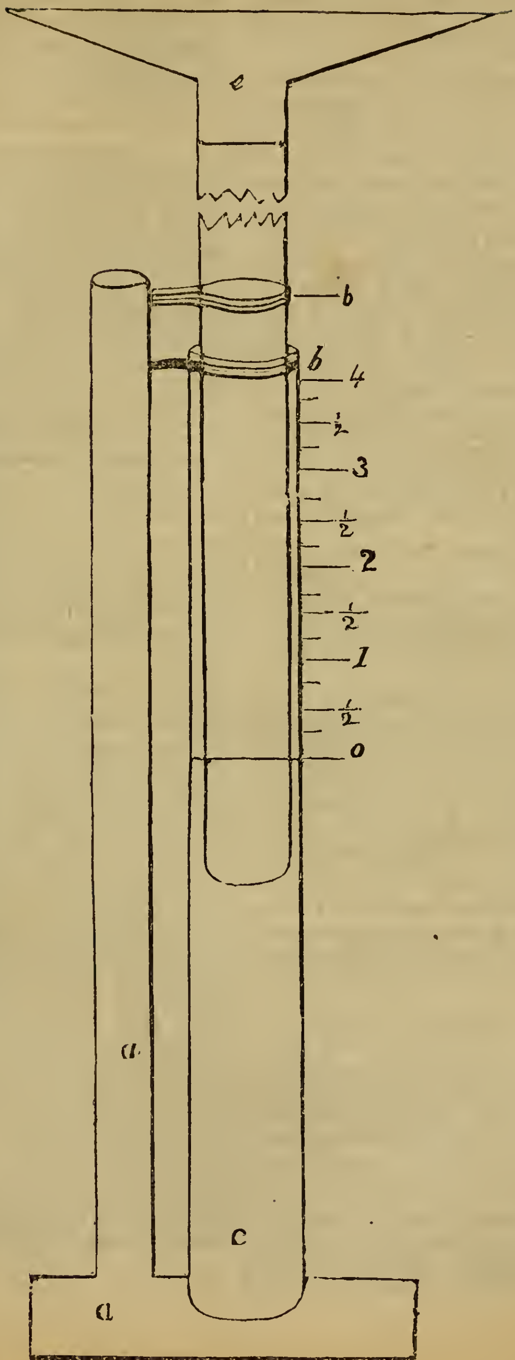
A. Z.

Brighton.

ON ALKALIES.

INTRODUCTION.

The alkalies are a class of chemical compounds, chiefly distinguished by their solubility in water; their power of changing the purple colour of infusion of red cabbage and radishes to a green, the reddened tincture of litmus to a purple, and the yellow colour of turmeric to a brown, and their power of neutralizing acids. The alkalies are a class of bodies which have properties the reverse of acids; they are considered as diametrically opposed to each other in their nature. An alkali has a peculiar taste, quite different to an acid; but, like them, is often caustic and poisonous. When, therefore, an alkali and an acid are mixed, we might naturally expect to have a compound doubly pernicious; but the reverse is the case. A familiar instance of this I may mention, that is, in



SIMPLE AND ELEGANT HYDRAULIC LETTER-BALANCE.

the composition of common salt. This salt may be obtained by the mixture of two very corrosive substances, i. e., muriatic acid and soda; they combine and neutralize each other, producing the mild and agreeable table salt, termed by chemists chloride of sodium. The alkalies of most importance in the arts and manufactures, are, potassa, soda, ammonia, and quina. The three former are likewise of great utility to the chemical philosopher. Chemists divide the alkalies into three classes, viz., the mineral (or those that have a metal for their base), the volatile (or that one that is exceedingly apt to assume the gaseous form), and the vegetable (or those that are never found in any other substance than of vegetable origin). The term alkali is of Arabian origin, and signifies the "dregs of bitterness." As an abridged sketch of the alkalies will appear in this periodical, it will be necessary to use the contractions; thus, V., Vegeto, prefixed to each alkali to denote its nature. They will be arranged in alphabetical order. I shall, therefore, begin with

Aconita (Vegeto).—This alkali is procured from the aconite, and is probably contained in several species of that plant. It is extremely poisonous. Its peculiar properties and combinations are but slightly known, and it has not yet been analysed.

Ammonia (V.)—This alkali in its purest state, is in the form of a gas, highly pungent, possessing all the mechanical properties of air; but is very condensable in water, that liquid being capable of taking up 460 times its bulk; this is then called liquid ammonia. For chemical experiments, it may be obtained by heating in a retort one part of sal ammoniac (muriate of ammonia), with two of quicklime, or by boiling the liquid ammonia. It must be collected in the mercurio-pneumatic trough, in consequence of its immediate condensation by water. Ammonia is composed of

$$\left.\begin{array}{l}\text{Hydrogen} \;..\; 3\\ \text{Nitrogen} \;....\; 1\end{array}\right\}\begin{array}{c}\text{condensed}\\ \text{into}\end{array}\left.\right\} 2 \quad \left.\begin{array}{r}82.53\\ 17.47\end{array}\right\} = 100$$

The base of ammonia is considered by Berzelius as a metal, which he terms *ammonium*; but his ideas as regards that substance are quite hypothetical, and are not generally adopted. Ammonia combines with the acids and forms neutral salts; the principal of which is the carbonate of ammonia, or smelling salts, and the muriate, or sal ammoniac. Ammoniacal gas extinguishes flame; but is itself partly combustible. A striking experiment may be performed, by conveying some carbonic acid gas into a jar containing ammoniacal gas; these two gases, when mixed, form a solid, which is carbonate of ammonia.

G. Piesse.

MISCELLANEA.

There is an instance hitherto unnoticed in the annals of English industry, where an article is raised in price by the manufacturer, from one halfpenny to the amount of 35,000 guineas! This occurs in the making of watch springs. A pound of crude iron costs one halfpenny; it is converted into steel; that steel into watch springs, every one of which is sold for half a guinea, and weighs only one-tenth of a grain. After deducting for waste, there are in a pound weight 7000 grains; it therefore affords steel for 70,000 watch springs, the value of which, at half a guinea each, is 35,000 guineas!

Pollen, the powder-like substance observed in flowers. From experiments made upon it by eminent chemists, it is found to differ on analysis in different plants. The pollen of the date is said to possess in its composition a likeness to animal substances. That of the hazel-nut flower may be said to have partly the nature of barks, tannin, resin, gluten, and fibrin entering into its composition. That of the tulip consists of much vegetable albumen, a little malate of lime, malic acid, malate of magnesia, saltpetre, and malate of ammonia. Malates are salts composed of malic acid (which is acid of apples) with different alkalies. Wm. V——e.

Strength of Materials.—Coulumb found that the force of torsion is equally powerful in wires, annealed and unannealed: they performed their vibrations in equal times. A tempered bar required also as much force to deflect it to a given angle as a hard one of the same dimensions. A soft bar, a spring-tempered, and a hard one, were bent to equal angles by five pounds; with six the hard bar broke; with seven the soft one bent, but returned as far from its new position, upon the removal of the weight, as if it had not bent. The elastic bar was broken by 18 pounds.

Novel Illumination.—The beautiful and intense light produced by the combustion of lime, was applied on Monday last to the purpose of illuminating the turrets of Vanburgh Castle, the residence of L. H. Potts, Esq., situated at the eastern entrance to Greenwich Park on the top of Maze Hill. We understand that this, which is generally known as the Drummond light, will be renewed at nine o'clock every Monday evening of her Majesty's honeymoon, [with various modifications, and directed towards London; so that our readers may contrast the intensity and penetrating power of different varieties of light. The effect of two lights used on this occasion, which were placed at some distance one above the other, was extremely brilliant and splendid; and although the moon shone brightly, the lights were discernible at a considerable distance.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Feb. 26, W. H. J. Traice, Esq., on Shakspeare's Comedy of "As you Like it." Friday, Feb. 28, Election of Officers. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Feb. 27, N. F. Zaba, Esq., on the History of Poland. At eight o'clock.

Poplar Institution, East India Road.—Tuesday, Feb. 25, T. Lewin, Esq., on Capital Punishment. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, Feb. 25, J. Mitchell, Esq., L. L. D., F. G. S., on Volcanoes. At eight o'clock.

QUERIES.

Can any of your numerous correspondents inform me how the following equation can be solved in the form of a pure quadratic?

Given $\begin{Bmatrix} x + y = a \\ x^3 - y^3 = b \end{Bmatrix}$ *to* find x and y?

E. Cooper.

What will take the stains of wood out of mahogany? W. J. C.

1. Which is the most durable in the open air, zinc or lead? 2. Where can I purchase patterns, such as carvers use? 3. The cheapest work on mathematical calculation concerning harmonics? C. G. Sidey.

The best method of keeping a common-place book; that is, under what heads should the subjects be arranged? Also, the best modern system of short-haud? J. P.

The best materials for polishing small garnets? I have tried diamond powder, but it is too sharp; it is also very expensive. I believe rotten-stone is used for that purpose, but I do not know how to apply it in the proper manner. I also wish to know of a cement (if there be one) better adapted to small work than shell-lac?

An Amateur Jeweller.

A description of the most superior lathe in general use, with the over-hand motions, &c., for working the engine-work on watches, nobs of parasols, &c.? Also, the most useful numbers for a dividing-plate, the pulley being only four inches in diameter? J. Nicklin.

Having been in the habit of making oxygen gas for particular purposes from the chlorate of potash, in order to have it pure, and this salt being very expensive, insomuch as to preclude many from using it; I shall feel myself personally obliged if any of your numerous correspondents would inform me of a simple method of making the salt alluded to. I understand that it can be procured by passing a stream of chlorine gas through a solution of potash; but if anyone could give me a description of the small apparatus requisite and the quantities employed, it would confer a great favour on

George Cooper.

1. Where can I purchase a bellows and blowpipe on a small scale for blowing glass tubes, &c.? 2. What is the scale for cutting the glass for the different notes for a harmonicon?

H. B. N.

What weight will be required to counterpoise a float of stone 4½ inches in thickness, 16 diameter, and immersed two-thirds of its thickness in fresh water? A. D. M.

1. How to make printing ink? 2. How to render soap transparent? 3. How to polish steel and iron, and what is used to polish white metals, such as British metal &c.? S. K.

I should feel much obliged, if any of your correspondents would inform me from practical observation, if it be really the case, that, when the spiral end of the toy, denominated "Rapert's Drop" is broken, the rest explodes; if so, the cause. I have made them more than once, but they do not burst, although I have severed the tail in several different places.

A Young Experimentalist.

How to make essence of ginger, lemon, and peppermint? How to make cloth waterproof? How to clean kid gloves? G. R. C.

The most complete and expeditious system of short-hand? Would like to be informed what system it is which is usually practised in the Houses of Parliament? How to make cheap black and blue ink? Also, how to make good pomatum? R. T.

1. How to make the best quick drying spirit varnish, used by cabinet makers and carvers for varnishing their turned and carved work? 2. How to make the inside of a lead cylinder true, for a piston to work up and down, because I want to try an experiment with it? 3. What sand is generally used for casting metal in? 4. How to make and use birdlime? 5. How can I obtain skeletons of birds and small animals? 6. How can I preserve the skins for stuffing? 7. How can we distinguish the different gases separately, and from what are they obtained? 8. I should like to know whether there is any vessel fitting up with air machinery, because I heard there was; if so, where is it fitting up? W. S.

ANSWERS TO QUERIES.

To make Fulminating Silver.—"R. H. H." Dissolve one drachm of silver in half an ounce of strong nitric acid, then add by degrees two ounces of pure alcohol. The whole must now be heated very gradually in a Florence flask, until ebullition commences; a white flocculi will soon appear, at which time the heat must be taken away. The action will still continue, and the precipitate will increase in quantity. When the action ceases, and the mass is cooled, it must be thrown on a filter and washed several times with distilled water; the powder remaining on the filter must be allowed to get dry, and the operation is completed. Great care must be taken not to touch the powder hard, as the slightest friction is capable of causing an explosion, and sometimes when under water. It detonates with a very slight touch, or by an increase of temperature, or when touched with sulphuric acid. I

should not advise your correspondent to make a larger quantity than what I have stated, as it is very dangerous. To prevent accident, it is best to separate the powder into several parts, and wrap them up in separate papers. Fulminating mercury is very explosive, and detonates with a loud report, but not so much so as fulminating silver.

A. TAYLOR.

Will of the Wisp.—"Mott." The gas which produces this singular appearance on stagnant pools, is hydouret of phosphorus, or phosphurctted hydrogen; it is formed in stagnant water, by the decomposition of vegetable and animal matter; it may however be produced by immersing a few pieces of phosphuret of calcium in water; the salt decomposes the water, the oxygen combining with the calcium, forming lime, while the hydrogen is disengaged, in combination with the phosphorus; it may be procured more easily, if the water used has a small quantity of hydrochloric acid mixed with it. Phosphuretted hydrogen, in its purest form is transparent, colourless, and not spontaneously inflammable at ordinary temperatures; but detonates with air, or oxygen, when heated to 300^0, or when the electric spark is passed through it. If prepared with potash or lime, in the manner described above, it is at first disengaged spontaneously inflammable. If the pure gas be mixed, even with $\frac{1}{10,000}$ of nitrous acid, it inflames as soon as it comes in contact with atmospheric air.

A YOUNG EXPERIMENTALIST.

A correspondent, "Wm. V——e," may ascertain the exact precision of thermometer tubes, by blowing a bulb and introducing a short column of mercury into the stem, about an inch in length, which is accurately measured on a fine scale of equal parts in different portions of the tube, as the column is by the heat of the hand moved from the bulb to the open extremity of the tube. Should the mercurial column subtend the same number of divisions on the scale in every part of the tube, it may be considered as a perfect tube for a thermometer.

H. B. N.

"Tyro Chemicus" may, I think, obtain the glass cylinders he speaks of, at Chaffin's glass warehouse, 69, Fleet Street.

J. MITCHELL.

Cement for the Joints of Cast Iron.—"Sherwood's" inquiry for a cement for the joints of his cast-iron water cisterns having met my eye in the 70th Number of your valuable periodical, I believe the one below, which I have used for some time as a cement for the joints of soap pans, will suit him:—20 lbs. cast-iron borings; 2 oz. flour of sulphur; 1 oz. muriate of ammonia. The materials must be intimately mixed in the dry state, when a sufficient quantity of warm water must be added to render the whole quite wet; the mass is then pressed together in a lump, and allowed to remain till such time, when the combined action of the materials renders it quite hot, in which state it must be hammered with proper tools into the joints. I would like to be acquainted, through the medium of your valuable work, if, after trial, Sherwood finds the above to answer his purpose.

W. G.

Liverpool.

"W. W." I beg to call your attention to a slight error which appeared in Nos. 76 and 77; it is this:—He says, "Put a piece of phosphuret of calcium, or phosphate of lime, into a glass of water," &c. Phosphate of lime would do no such thing as decompose water. Phosphuret of calcium, and *phosphate* of lime are totally different; the former is black, or nearly so, the latter white as driven snow. Phosphate of lime is the principal constituent of the bones of the human body. A pretty state we should be in, if our bones were to produce an inflammable gas by the addition of water. He is quite right as regards phosphuret of calcium.

G. W. S. PIESSE.

In your last number, a correspondent asks for a cheap plan for making either a theodolite or quadrant. There is no cheap method of making either correctly, as the division of the degrces, &c., unless done by a proper machine, will cause every calculation to be false. I have at present by me an excellent quadrant, quite perfect, which I wish to dispose of at a cheap rate; and should your correspondent like to take it, I shall be happy to give him any information concerning the use of the instrument. I can also tell him of a cheap little book that would give him every information about it.

S——.

9, Upper St. Martin's Lane, Long Acre.

TO CORRESPONDENTS.

W. J. C. *will see that the Mechanical and Chemical Society is in progress, and a place of meeting appointed and published in our last.*

P. T. J.—*The springs which produce a sound resembling a church bell, are formed by bending a long slender rod of steel in a spiral form, similar to the pendulum spring of a watch; they are attached at the outward extremity by a screw, and are small at each end, the thickest part being about the middle. When a particular note is required, they are tuned by reducing the outward extremity next to the screw, which lowers the tone; but if they should be too low, they may be raised by taking off a part of the end in the centre of the spiral. They should be hardened, and let down to about the temper of a watch spring (which is a pale blue, showing a dull red in the dark); but it must be observed, that the proper sound cannot be obtained without fixing them, or the plate to which they are attached, to a sufficiently large surface of wood, or some other material proper for conducting and developing sound. The springs in French repeating watches are made on this principle; but they produce little sound when not enclosed in the case. Their size must be proportional to the extent of the sonorous body to which they are attached; that is, the conducting body must be of sufficient dimensions; but no inconvenience will result from its exceeding those dimensions.*

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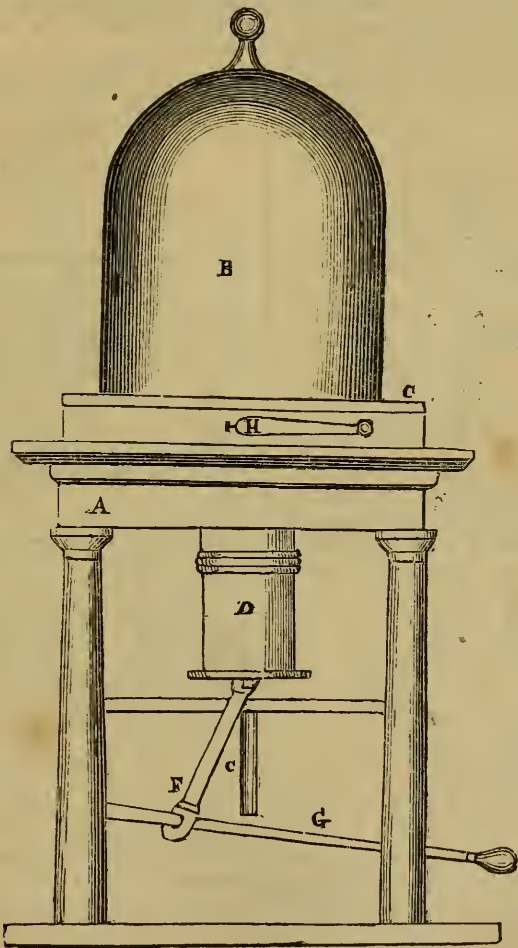
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 79, NEW SERIES. | SATURDAY, FEB. 29, 1840. PRICE ONE PENNY. | No. 200, OLD SERIES.

JOUGE'S AIR-PUMP.



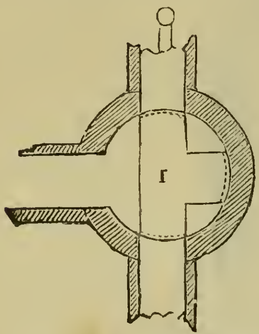
 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

JOUGE'S AIR-PUMP.

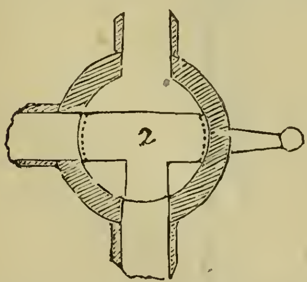
(See Engraving, front page.)

To the Editor of the Mechanic and Chemist

Sir,—I take this opportunity to send you a sketch of an air-pump, of the most simple construction that I am acquainted with. H is the frame; B, receiver; C, pump plate; D, cylinder; E, piston rod; F, connecting rod; G, lever to work the pump; A, lever to work the three-way cock. And now that you have got the description, you will want to know how it must be worked; this I will explain to you as plainly as I possibly can. Suppose you wished to exhaust the air out of the receiver, B, you must raise the lever, G, up to the top; then place the cock in the position shown in fig. 1; press down the lever, G, to the bot-



tom, and by that means you will exhaust one cylinder-full of air out of the receiver; now pull down the lever, H, to the position shown in fig. 2; raise the lever, G,



and you will force the air out of the cylinder; and by thus continuing to alter the position of the cock, and to raise and depress the piston, you will exhaust the air out of the receiver. But it often happens, when we are making experiments in pneumatics, that we wish to condense the air, and sometimes to a great degree; this an be done by a pump of the above description, without making any additions or alterations in the machine; and I will show you how:—Fasten the receiver on to the plate by any of the usual methods; press down the lever, G; place the cock in the position, fig. 1; raise the lever, G, and you will force a cylinder-full of air into the receiver; alter the position of the cock to fig. 2; press down the lever, G, and the air will rush into the cylinder, ready to be forced into the receiver. It is not necessary to form the frame in the manner shown in the sketch; but, as I am about to make one on that plan, I thought it would be as well to give you a view of the pump as it will stand when completed.

I remain yours, &c.,

Charles Wm. Jouge.

Manchester.

ON THE METALS.

(From Hope's "Practical Chemist.")

(*Continued from page* 208.)

MAGNESIUM—12.

Common calcined magnesia is an oxide of a metal called magnesium. This metal was discovered by Sir Humphrey Davy, in 1807, by means of the galvanic battery; but in quantities too small to determine its properties. It was prepared by M. Bussy, a French chemist, in 1830, by heating small pieces of potassium in a platinum crucible with chloride of magnesium.

Rationale. — The chlorine leaves the magnesium and unites with the potassium, forming a chloride of potassium, and pure magnesium is left.

Magnesium is a white metal resembling silver, slightly malleable, and of a brilliant metallic lustre. It melts at a red heat, is slowly oxidized in moist air, but undergoes no change in dry air. When heated to redness in air or oxygen, it takes fire and burns with great brilliancy, forming magnesia.

MAGNESIA—20.

This compound is extensively used in medicine, and is prepared by heating the carbonate of magnesia until the carbonic acid is expelled. This process is called *calcining*, and the product, calcined *magnesia*.

Calcined magnesia is a white powder, extremely light, nearly insoluble in water, and when mixed with that liquid containing a solution of blue cabbage, the latter is changed to green, proving the alkaline nature of magnesia. It is composed of 1

atom of metal (12), and 1 of oxygen (8): its equivalent is therefore 20.

Magnesia forms a large portion of many common minerals, some of which are extensively used in the arts, such as soapstone, some kinds of marble, serpentine rock, asbestos, &c.

Obs.—Asbestos is the celebrated incombuscible material; so flexible as to be spun and woven into cloth, of which garments have been made and exhibited as articles of great curiosity. These, when soiled, are cleansed by throwing them into the fire, which burns off the dirt, and thus the article is recovered, fresh and well cleansed.

EARTHY METALS AND THEIR COMBINATIONS WITH THE PRECEDING BODIES.

Aluminum, Glucinum, Yttrium, Thorinum, and Zirconium.

ALUMINUM.—14.

Aluminum is a white metal resembling silver, and is procured from the chloride by means of potassium, by a process similar to that for obtaining magnesium. When heated to redness, in air or pure oxygen, it takes fire and burns with great brilliancy, forming an oxide of this metal called *alumina* or *alumine.*

ALUMINA.—26.

Alumina is a compound of oxygen and aluminum, and is composed of 1 atom of metal (14), and 1½ of oxygen (12), its equivalent is therefore 26.

Alumina is one of the most abundant productions of nature. It is found in every region of the globe, under the name of clay, which is alumina in a greater or less degree of purity, and constitutes the chief material of which bricks, pipes, and earthenware are manufactured. It is also used in the preparation of common alum. Those clays which, when burnt, become red, contain oxide of iron, as seen in common bricks, which owe their colour to the presence of this substance. The ruby and sapphire, the oriental amethyst, emerald, and topaz, are nearly pure alumina, in a crystalline state.

Obs.—*Materials used in Pottery.*—Common brown earthenware is made of clay, which contains oxide of iron, giving it a reddish brown colour. This ware also contains considerable silica, which prevents it from cracking by sudden heat or cold.

2. White earthenware is made of very pure pipe-clay, that contains no iron; but silica forms a prominent ingredient, and if it be not contained in the clay, it is added by the manufacturer in the form of pure white sand.

3. *Porcelain,* called also chinaware, from its being first imported from that country, contains the same ingredients as white earthen, with the addition of a mineral called feldspar, which causes the ware to be translucent when baked.

4. *Manufacture of the Ware.*—The materials, mixed with water in sufficient quantity to form them into a very stiff paste, are moulded upon the potter's wheel, a very ancient instrument, mentioned by the earliest writers, both sacred and profane. A mass of the clay is placed in the centre of the wheel, during the revolution of which the material is moulded by the hands of the potter into the desired shape. If the articles are too thick, they are afterwards turned in a lathe to make them thinner. Handles, spouts, &c., are made separately, and put on afterwards by means of a thin paste of the clay.

5. *Baking of the Ware.*—The vessels are dried in the open air, or in stove rooms, and then exposed to a high heat in ovens for about two days; at the end of which, they are allowed to cool gradually, and are withdrawn from the ovens in a state of biscuit, as it is denominated by the workmen.

6. *Glazing.*—To prevent the absorption of liquids, and to preserve the cleanliness of the ware, it is covered with a thin film of vitreous or glassy matter called glazing, the composition of which differs in different kinds of ware. In common stoneware, which is made of clay only, the glazing consists of common salt. The operation is performed by throwing the salt into the furnaces or ovens when the ware is baking; the vapour of the salt, at a high heat, coming in contact with the vessels, partially vitrifies their outer surfaces, and gives a smooth and uniform covering. The inner surface contains no other glazing than the clay itself; hence this kind of ware is the best for preserving pickles, and other articles preserved in vinegar.

7. Common brown earthenware is glazed with a mixture of fine sand, white lead and common salt, ground very fine and mixed with water. The ware in the state of biscuit, is covered with this mixture, and then transferred to the ovens for melting on the glazing. This glazing is dangerous from the poisonous nature of the lead, which is dissolved by the acids contained in cider, wines, vinegar, &c.; hence articles containing acid should never be kept in brown earthen vessels. The glazing of the finer kinds of earthenware

contains the same ingredients as that of the brown ware, but in different proportions. That of the chinaware is composed entirely of the mineral feldspar, and is not acted upon by acids.

8. The blue colour is given to earthenware by an oxide of cobalt; green, by oxide of chromium. The lustre-ware, which has a bronze tint, is produced by an oxide of gold mixed with amber or red clay. The steel-coloured ware is produced by platinum, which is put on the ware after it is glazed; the metal is dissolved in nitro-muriatic acid,* and laid upon the ware, which is then put into the oven, exposed to a strong heat, and subsequently burnished. The gilded ware is covered with gold, by first dissolving that metal in nitro-muriatic acid, and the remainder of the process is conducted in the same manner as that described for platinum. The gilt-edged tea-sets, and other domestic articles, are prepared in this manner.

GLUCINUM.—18.

Glucinum is a very rare metal, of a feeble metallic lustre, the oxide of which is called *glucina*, and constitutes a considerable portion of the emerald and beryl. It has no uses in the arts.

YTTRIUM.—32.

Derives its name from Ytterby, a town in Sweden, where yttria, which is an oxide of this metal, was discovered. The salts of yttria are characterized by a sweet taste, as well as those of glucina.

THORINUM.—60.

Thorinum, or thorium, as it has sometimes been called, is a new metal, discovered about two years ago, by Berzelius, of Sweden, in a mineral called *thorite*, in which the metal exists in the state of an oxide, called *thorina*. Thorinum and all its compounds are exceedingly rare, and have not been used in the arts.

ZIRCONIUM.—30.

This metal, like the three last mentioned, is very rare. It was first obtained by Professor Berzelius, in 1824. Its oxide, called zirconia, is a pure earth, but exists only in a few rare minerals.

Obs.—The compounds of the four last elements that have been thus briefly described, have little to interest the pupil, and are therefore omitted.

* A mixture of nitric and muriatic acid, the only liquid that will dissolve gold or platinum.

LIFE ASSURANCE.

NO. I.

INTRODUCTION.

An apparent inducement has been held forth by some of the conductors of this magazine, for some farther remarks on the nature and principles of life assurance. A promise was also given by a writer in page 202, of a return to "the more pleasing task of examining some of the substantial, honourable, and benevolent institutions," which is now most cheerfully complied with.

But before advancing too far, it will be necessary to make some introductory observations upon this important subject, and to explain a few of the mystical bearings of the doctrine to such readers as have not hitherto devoted much attention to the subject. The writer would likewise remark, that some reference will be made in the future, in connexion with the present details, to his letter upon "Loan Societies" (page 202), and the plan there proposed; thus to afford the readers of this magazine at once a clear and succinct account of the most improved method of the day, for raising an immediate fund or future provision.

The theory of life assurance has been greatly improved within the last fifty years; it is mainly founded, as the reader will be pleased to notice, upon many facts connected with the mortality of human life. When it was discovered by the "bills of mortality," from even before the time of the great plague, that a usual number of deaths took place in several years, and that in the succeeding year a similar amount died, compared with the number then alive; it became a matter of expectancy with those who had made these observations, that out of every 10,000 alive the following year, a certain number might be expected to die. The first tables which we will merely notice of this kind, were formed by Halley, or De Moivre, from observations made in the town of Breslau, in the years 1687 and 1691; but as these tables are not much used, let us notice two other series of tables more particularly. The first of these was formed by Dr. Price, of Northampton, from the mortality of that town in the years 1741 and 1780, the number of male and female deaths being nearly equal. The following table will show the decrease of the number of 10,000 persons born, at every interval of five years, according to the Northampton tables:—

Age.	No. Living.	Decrement.
0	10,000	
5	5,356	4,644
10	4.864	492
15	4,648	216
20	4,399	249
25	4,080	319
30	3,759	321
35	3,437	322
40	3,116	321
45	2,784	332
50	2,449	335
&c.	&c.	&c.

Thus we find in the first column the age, say ten years; there are 4,864 living, and of this number 216 are expected to die before attaining the age of fifteen. These tables were, and are, at the present time, very extensively used by the assurance offices.

The next tables we will mention, are those of Mr. Milne, from the observations of Dr. Heysham, upon the mortality of the town of Carlisle in the years 1779 and 1787, and hence called the Carlisle tables. Mr. Milne has here shown, that life is to be considered more healthy than computed in the tables of Dr. Price; and, from the experience of the Equitable Society of London during the last fifty years, and the more enlightened state of society at the present day, there is every reason to believe so. Other tables of this kind have been constructed; but the two we have described are those more generally relied upon.

It will now be seen by the commonest observer, that there is great importance to be attached to the above statements, which have been tested by the experience of nearly a century. And it is quite as natural to suppose, that by an arithmetical operation, some information would arise as to the value of a sum of money at the expected death of an individual. Nor would it be presuming too much to say, that in the earliest stages of this theory of expectancy, some laws of probability might be made with a certain degree of success. For example, if 100 persons were, by the Northampton tables, to assure each others' lives; or, in other words, agree that at the time of death each should have 100*l.*; they could, without much difficulty, ascertain how long, by the above tables, they might expect to live, and, consequently, the necessary cost. Now, supposing each was aged forty, which would be a favourable coincidence; they might conclude that their average life would be about twenty-five years longer, or until they were aged sixty-five. But as this expression is by way of average, it will be necessary to remark, that about ten would be expected to die in the first five years; and, before the age of one hundred years, all would die, as follows:—

Age.	No. of Deaths.	
45	10.27	first five years.
50	10.36	next five years.
55	10.84	ditto.
60	10.84	ditto.
65	10.75	ditto.
70	10.66	ditto.
75	10.65	ditto.
80	9.84	ditto.
85	7.85	ditto.
90	4.66	ditto.
95	2.19	ditto.
100	1.09	ditto.
Total	100.	

Undoubtedly the preceding is mathematically incorrect, and only approximates nearly to the truth, supposing the tables perfectly true. Still it may be said the error is on the right side, and hence there would be gain to an office making such a calculation; but that must be explained hereafter.

The word *probability* has been used, and must now be explained. In the above estimate, it would be a great improbability, supposing some person was expected to live until 95, that 99 of the 100 would die aged 50. On the other hand, if 100 persons were each aged 40, it would be termed the highest degree of probability, that all those persons could not attain 90 years of age. This will explain the motive for viewing, what is commonly called chance, with the eye of probability; for, in mathematical reasoning, the word *certainty* cannot be here introduced.

Now before we advance farther in the explanation of this subject, which we propose to do systematically; it will be of the greatest importance, that the reader's mind should be free from that feeling called prejudice. For we would argue, from what has already been stated, that there is a great probability that the accounts of mortality handed down to us are nearly correct; and there is likewise a probability, that some society now existing was based upon right principles in its formation; or, rather, there is a very high degree of probability, that a line can be now drawn, to which the sum of former statements, and the experience of past

years, will converge in one point, resembling the truth.

If, then, these facts can be listened to attentively, and we intend to use technical phrases as little as possible, no doubt many will become persuaded of their importance who have hitherto deemed the subtle doctrine of life assurance, crude and fallacious.

SIGMA.

THE CHEMIST.

THE ELEMENTS AND THEIR COMBINATIONS.

(Continued from page 198.)

HYDROGEN has also been found to change the tone of the voice when inhaled; this effect is observed on the person speaking immediately after ceasing to breathe it, but it soon goes off. The flame of hydrogen is employed to produce intense heat when mixed with oxygen, and burnt as the mixture issues from a small jet. The flame of the mixed gases, when projected on lime, is also employed for the purpose of illumination, under the name of Drummond's light, and is also the same as the koniaphostic light lately exhibited at the Surrey Gardens.

Combinations of Hydrogen and Oxygen.—If two volumes of hydrogen and one of pure oxygen be ignited in a proper vessel by the electric spark, the gases will combine, and the interior of the vessel will be covered with pure water, equal in weight to the gases consumed. If pure water be exposed to the action of voltaic electricity, it is resolved into two volumes of hydrogen disengaged at the negative pole, and one volume of oxygen disengaged at the positive pole; so that water is proved, both by analysis and synthesis, to consist of two volumes of hydrogen and one of oxygen. The specific gravity of hydrogen compared with oxygen, is as 1 to 16, therefore the component parts of water by weight are,

1 Proportional of hydrogen	1
1 Ditto of oxygen	8
Equivalent of water	9

Or thus:—

Hydrogen 1	Oxygen 8	Water 9 Symbol H.

For performing these experiments with accuracy, a delicacy of apparatus, as well as of manipulation, will be required, which the student can scarcely be expected to command. He may, however, satisfy himself of the truth of the doctrine by the following simple process:—Into a glass bottle adapt a cork, through which a small tube passes; introduce a small quantity of iron filings, and pour upon them diluted sulphuric acid. Inflame the hydrogen as it issues from the orifice of the tube, and hold an inverted jar over the flame. In a short time its interior surface will be covered with a very fine dew, which is pure water, produced from the combustion of the hydrogen gas and the oxygen of the atmosphere. The hydrogen should be allowed to pass off for some little time before it is inflamed, in order to drive the atmospheric air from the bottle, the presence of which might otherwise occasion explosion. Water, in its ordinary state, such as *spring* and *river* water is always so far contaminated with foreign substances, as to be unfit for many chemical purposes, and frequently even for domestic use. *Rain* water is much more pure; but it always contains a portion of carbonic acid, and of the elements of atmospheric air. The distinction of water into *hard* and *soft*, has reference to its less or greater purity. The impurities of water are separated by distillation. *Distilled* water, as commonly prepared, always affords minute traces of foreign matter, especially when subjected to the voltaic decomposition, and can only be considered as perfectly pure when redistilled at a low temperature in silver vessels. Pure water is without taste, smell, or colour. It is a powerful refractor of light, and a very imperfect conductor of heat and electricity. In consequence of the facility of obtaining it pure, it is assumed as a standard, to which the relative weight of all other bodies may be compared; its specific gravity being called = 1.000, and hence the importance of estimating its

weight with precision. At the temperature of 40°, it is at its maximum of density; and at that temperature an English cubic foot weighs 437102.4946 grains, or 999.0914161 ounces avoirdupois, and a cubic inch 252.953 grains. It is, therefore, about 828 times heavier than atmospheric air.

At the temperature of 32° water congeals into ice, which, if slowly formed, produces needles crossing each other at angles of 60° and 120°. Their forms are various; but the primitive figure has not been ascertained, though it is probably rhomboidal. The specific gravity of ice is 0.94, or thereabouts, varying a little in consequence of the air bubbles which it includes. The densest ice, however, obtained by freezing water deprived of air, is always lighter than water itself. In freezing, the water expands with such force, as to burst very thick and strong vessels in which it is confined. The most interesting experiments upon the subject, are those of Major Williams. Bombshells, about thirteen inches in diameter, and more than two inches thick, were filled with water; the fuse holes were then plugged with iron bolts, and, thus charged, were exposed to the open air, at a temperature between 4° and 19°. At the moment of congelation the plugs were thrown out, and the ice protruded through the fuse hole. When the plug was duly secured, the shell itself burst. The greatest difference observed in those experiments between the bulk of water before and after congelation, was : 174 : 184. If water be exposed to heat in open vessels, it boils, or is converted into steam at 212°, the barometer being at thirty inches; but the boiling point of water varies considerably with the pressure. At mean pressure and temperature of 212°, the bulk of steam is about 1700 times greater than that of water. Water is susceptible of compression, as was originally shown by Canton, and more lately by Mr. Perkins. He finds, that a pressure of 2000 atmospheres occasions a diminution of one-twelfth of its bulk. Water enters into combination with a variety of substances, and is retained with various degrees of force; where it contributes to the regular form and transparency of crystallized bodies: it is called the *water of crystallization.* In other cases, the compounds which water forms with substances, are termed hydrates; as with many of the metallic oxides; in both cases, it may be considered as one of the constituents of the bodies; for it exists in them in a definite proportion.

Water is a most general and useful solvent, especially of saline bodies, the relative solubilities of which will be stated under their individual chemical histories.

J. MITCHELL.

(*To be continued.*)

MECHANICAL AND CHEMICAL SOCIETY.

IT is particularly requested, that all persons residing in London, willing to join, or help in the formation of a "London Mechanical and Chemical Society," will forward their addresses by post to "TYRO CHEMICUS," Essex and Temple Coffee-house, 43, Essex Street, Strand, where they will meet with immediate attention; and if sufficient, a meeting will be called, and other preliminaries arranged, relative to the immediate establishment of the Society. No letters will be taken in unless post paid. Communicating as early as possible will oblige

TYRO CHEMICUS.

P. S. Tyro Chemicus presents his thanks for the numerous letters which he has received with assurances of support, and thinks that in a short time the Society will be established. Letters directed as above will oblige, and receive every attention. T. C.

Feb. 24, 1840.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, March 4, Quarterly Meeting, At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 5, the Rev. Dr. Vaughan, on Ancient Egypt. At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 3, J. Robinson, Esq., on Pneumatic Chemistry. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 3, W. H. J. Traicc, Esq., on Shakspeare's Comedy of "As You Like It," with Illustrations. At eight o'clock.

QUERIES.

Sir,—Allow me to inquire, through the medium of your valuable work, the best method of transferring an engraving from paper on to wood, as we see them on small work-boxes, &c.? Also the best plan to turn a good sphere, being fond of turning for amusement, when my avocations will allow me time, having a large family to maintain. I have not the means of seeing these things as I might if I had more leisure; my business is quite in a different line, but am still fond of little things of this kind that are within my reach. I

have a very good foot lathe, with some little tackle about it, that have come out of my earnings, instead of being spent at the alehouses, which to me is a source of considerable pleasure; and some time or other you may, perhaps, give a description of a good eccentric chuck and slide rest. You will oblige me by giving, as early as convenient, the best method of burning hydrogen and oxygen on lime, and whether it is used as a light or not? B. O. J.

Ackrington.

[We deviate from our usual method, in inserting the above letter unabbreviated. We could not withhold from our readers so pleasing a picture of contentment and happiness in spite of fortune, and so striking a contrast with the misery which springs from the lawless and dangerous pursuits into which rash and misguided men are too often enticed by false friends. It is also an example of one of the many benefits which a poor man may derive from the general penny postage. Our worthy correspondent will find an answer to his last query in page 288 of the present number. To turn a sphere, it is only necessary to fix in the lathe a piece of the required material, cut into nearly the shape and size of the intended sphere, and strike a groove as near as possible in the middle of the block, and cut it down till it measures the diameter of the sphere required; then, by measurement, or trial in the lathe, form two centres on opposite sides of the groove, and turn off the projecting parts till the groove just disappears, and you will have a perfect sphere. This method, if correctly performed, is geometrically true; for a sphere is a figure formed by the revolution of a semicircle about its diameter, which is the principle upon which this operation is founded.—Ed.]

ANSWER TO QUERIES.

The Power of a Steam Engine is found thus:—Multiply the pressure of steam in the boiler in pounds per square inch, by the decimal .39, the product will be the effective pressure; then, multiply the number of square inches in the area of the cylinder by the effective pressure as above, that product by the number of feet the piston travels in a minute, and divide by 32,000; the quotient will be the power of the engine. Thus, an 8-inch cylinder is in area 50 square inches. Force of steam in the boiler

$17\frac{1}{2}$ lbs. $\times$ .39 = 6.8 lb. per square inch.

400
300

3400
220 feet per minute;

68
68

32000)74800(2.3 horses' power.
64000

10800
96000

12000

G. Mitchell.

TO CORRESPONDENTS.

The Penny Postage.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the "*Mechanic and Chemist*" is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half a Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half a Crown.*

All letters to be prepaid, and addressed to D. A. Doudney, *City Press,* 1, *Long Lane, Aldersgate Street.*

G. Piesse *proposes the following singular question:—What would be the consequence if an* irresistable *body were to come in contact with an* immoveable *one? We are not disposed to deprive our talented correspondents of an opportunity of answering this question, but recommend them not to condemn it as foolish, since immobility and perfect hardness are frequently* supposed *to exist in separate bodies in mechanical problems. The fact which will be established by the proper consideration of this question, we shall not at present anticipate. His other query is answered, p.* 229.

H. B. N. *may see a table blowpipe, by applying to Mr. J. Day,* 12, *Whitfield Street, Leonard Street, Finsbury.*

X. Y. Z.—*We shall be happy to receive the paper he mentions.*

J. B. *requests that the date of his invention of a double-jetted blowpipe, a drawing and description of which we have received, should be recorded, which we accordingly do: it is Feb.* 22, 1840. *It will appear when the engraving is ready.*

D. L—y.—*We cannot perceive the utility of multiplying the forms and patterns of letter scales, without rendering the operation of weighing, either more rapid or more accurate than in the simplest construction of an ordinary scale. We have, however, a drawing at the engraver's of a very ingenious contrivance, which we expect will be pronounced far superior to any that have yet been presented to the public.*

Alex. Mills *has not propounded his question with sufficient precision to be intelligible. What does he mean by "a velocity equal to that in a circle at the same distance?"*

We must unavoidably defer till our next the notice of numerous communications.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

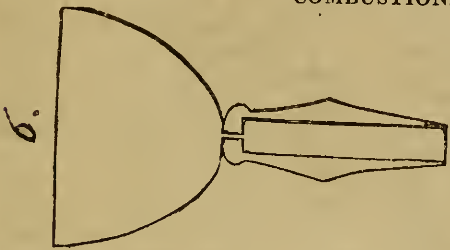
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 80, NEW SERIES. | SATURDAY, MARCH 7, 1840. PRICE ONE PENNY. | No. 201, OLD SERIES.

COMBUSTION.



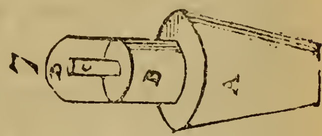
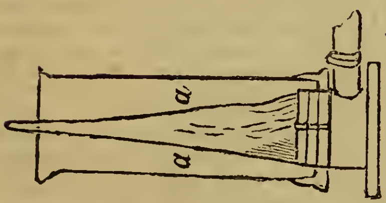


Fig. 5.



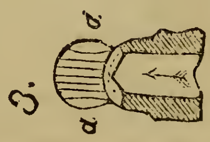
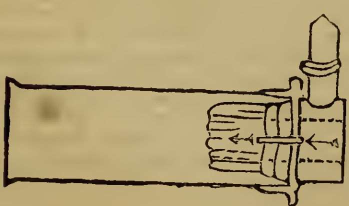
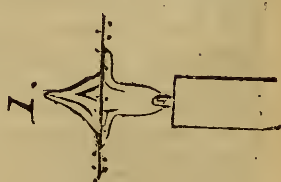


Fig. 4.





City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

ON COMBUSTION.

(Continued from page 204.)

(See Engraving, front page.)

THE nature of flame is beautifully illustrated by holding a piece of wire gauze, about 1000 meshes in the sqrare inch, over the flame of a candle or a large stream of gas. The flame is intercepted, and appears only below the gauze; a tube or flame appearing expanded as it reaches it. The unconsumed gas rises through the gauze, and if a lighted match be applied, it burns on the upper side; the appearance is then presented as seen in fig. 1.

The solution of this is, simply, that flame will not exist without it is kept at the full white heat; therefore, when we hold the gauze over the candle, the flame, in trying to pass through, is cooled below the burning point. Upon this principle is constructed Sir Humphrey Davy's safety-lamp. In coal mines the atmosphere frequently becomes explosive, from the large quantity of bihyduret of carbon, the fire-damp of miners, which escapes from the coal as it is worked. A light would instantly detonate the mixture; but with this lamp, though the explosive mixture may enter within the gauze and burn there, the flame within cannot set fire to it without, so that the miner has time to escape. By the sudden glare of light, the miner is informed that such an explosive mixture is near. From what has been said, the construction of the safety-lamp will be easily understood. *a*, fig. 2, is a lamp surrounded with a tube of wire gauze, *b b b b*, supported by three iron rods, which also serve for the handle. The lamp is now generally surrounded with talk, in order to preserve it from sudden gusts of wind, which sometimes carry the flame through the gauze, endangering the safety of miners, and also a magnifying glass, which increases he light.

Lamps are now constructed, so as to allow a current of air to pass through the centre of the flame, to which are given the name of Argand burners. They are made to burn oil as well as gas; but I shall simply describe the gas Argand burner. It is formed of a circle of small jets, a section of which is seen at fig. 3; a current of air passing in the direction of the arrow. A full view is shown in fig. 4. In an Argand burner the intensity of the heat is augmented; so that more gas is consumed within a given space than in the ordinary manner. In fig. 3, it will be seen, that the surfaces of the burning gas, *a a*, *a a*, are very near, so that the interposed gas is heated much more than when these surfaces are distant. Much carbon, therefore, is precipitated, and becomes intensely luminous before it is consumed. If the aperture by which the air is admitted into the interior of the flame be closed, the flame represented in fig. 4 immediately assumes the form shown in fig. 5; part of the supply of air being cut off, it extends farther into the air before it meets with the oxygen necessary for its combustion. The heat is accordingly diffused over a larger surface, and becomes less intense; *a* and *a* are more distant from each other, a smaller quantity of carbon is deposited, less gas being decomposed; and even that which is separated, being less intensely heated, much of it is unconsumed, and produces a dingy and imperfect flame. A current of oxygen, instead of air, passed through the Argand burner, forms the Bude light. The most perfect form of burner is seen in the flat gas jet, fig. 6, where two opposing currents of gas meeting each other, flash into an extremely thin sheet of gas, which extends in an opposite direction to the currents which produce it. Here, the gas on one side being so extremely near that on the other, all the conditions are fulfilled which are necessary for intense heat and light. A very excellent gas burner is also described in No. 49, N. S., invented by Mr. Dockree.

With regard to oil lamps, there is very little variety in their construction, some having flat wicks, others round; but the best form is the circular wicks, allowing a current of air to pass through the centre, called the oil Argand lamp. Those used by chemists are called spirit lamps, and are made upon the same construction as those for oil. A very cheap and useful spirit lamp is made as follows:—Take a piece of glass tube about an inch and a half in length; make a hole through a small cork, and pass the tube through, till it projects at the upper end half an inch; then procure a short wide-mouthed bottle, and adapt a cork to it; perforate this cork also, and fit the smaller one into it in such manner, that the top of the one holding the tube may be about a third of an inch above the top of the other: the wick of the lamp is to pass through the tube and dip into the spirit below. To prevent the latter evaporating when the lamp is not in use, cut off the sealed end of a test tube, of such diameter that its inner surface may accurately receive and closely fit the small cork, and sufficiently long to cover the small tube and

wick. Press the whole firmly together, when the instrument is put aside; but the large cork must be loosened when it is burning, otherwise the spirit will not properly rise. In fig. 7, A represents the large cork; B, the small one fixed in it; C, the glass tube for the wick, and D, the end of the test tube, to prevent the evaporation of the spirit. I am still of an opinion, that lamps are far from being perfect, and I think it deserves more attention than is at present paid to it. I have long thought of the possibility of forming a wick which would not be consumed, so that it would require no snuffing, and would last for a length of time without any renewing. A few hints on this subject I must reserve for a future paper.

FELIX WEISS.

Liverpool.

(To be continued.)

ON LAND SURVEYING.

WITH regard to the origin of land surveying, historians differ very much in their opinions. Diodorus, Herodotus, and Strabo, attributed the invention of it to the Egyptians, whom they represent as constrained by the annual inundation of the Nile removing or defacing their landmarks, to devise some method of ascertaining the ancient boundaries after the waters had retired. By Josephus, however, it is ascribed to the Hebrews. According to him, the arts and sciences of Egypt were derived from the patriarch Abraham, who conveyed them into that country from the Chaldees.

Originally the science was called geometry; but this being deemed too comprehensive a title for the mensuration of superficies, it was afterwards denominated "the art of measuring land."

From the banks of the Nile it was carried into Greece by Thales, one of the seven wise men, born before Christ 640 years. This philosopher travelled into Egypt, and studied, under its sages, astronomy, geometry, and other branches of the mathematics; but having given offence to King Amasis, by the freedom of his remarks upon the conduct of princes, he returned home and employed himself in communicating the knowledge which he had acquired.

The great utility of land surveying, without which it is impossible to conduct the affairs of civilized life, induced many of the most celebrated philosophers and mathematicians of antiquity to study its principles; and to Thales, Pythagoras, Socrates, Plato, Aristotle, Euclid, Archimedes, &c., we are indebted for many substantial improvements. The ancient Romans likewise, it is said, held this art in such high veneration, that they accounted no man capable of commanding a legion, who was incapable of measuring a field.

But formerly, people not having the power to sell or alter their estates, any particular accuracy in land surveying was not required; but when they were permitted to do so, and land in consequence was daily changing owners, and also becoming more valuable; it became necessary to ascertain the area of each person's property with the greatest accuracy, and which has been fully accomplished by modern surveyors. It has also been carried to great perfection since the passing of the Tythe Commutation Act, which requires that surveyors of parishes shall deliver up their field books for the purpose of testing their work, and which has had the effect of showing who are good surveyors and who are not.

G. R.

EXPERIMENTS ON THE BAROMETER.

To the Editor of the Mechanic and Chemist.

SIR,—In a treatise which I lately read on the barometer, the author states, that at the level of the sea, the mean height of the mercury is the same all over the globe. He also states, that it was never known to fall lower than 28 inches in England. Am I to infer from this, that it sinks no lower than 28 inches in the far northern and southern regions.

Again, from my own observation I have found, that when the thermometer rises from the effect of heat, the barometer sinks in like proportion, and on the contrary. This to me seems mysterious, as it is a law, that all bodies expand by heat. A speedy insertion and solution of these queries in and by means of your valuable paper, will greatly oblige the writer.

J. B—N.

Birmingham.

[The variations in the pressure of the atmosphere, and, consequently, in the height of the mercury in the barometer, depend upon various causes: the greatest depression occurs in violent hurricanes, such as are experienced in the West Indies and other countries in or near the tropics. When the barometer indicates a great and sudden decrease of atmospheric

pressure under these circumstances, it is supposed that winds blowing in different directions from the same place, partially exhaust the incumbent column of air at that place; and this opinion seems to be corroborated by the rapid rise which follows, indicating the reflux of the surrounding air into the vacuum thus formed. It is also probable, that the tangential motion of the wind may have some effect in lessening the downward pressure; for it is, by the rectilinear force of its momentum, constantly endeavouring to quit the curved surface of the earth, and thus, to some extent, counteracting the gravity of the superincumbent column. The phenomenon of the barometer appearing to fall when the thermometer rises, is easily explained; in the thermometer, heat expands both the glass tube and the mercury within it; but the mercury increasing in bulk, more than the tube increases in capacity, the mercury is forced upwards; and the height of the mercury indicates the excess of its expansion above that of the tube. In the barometer, the same expansions take place; but the mercury not being confined, flows down into the reservoir below, and the atmospheric pressure still sustains its equivalent column of mercury—something higher, indeed, than before the expansion, because its specific gravity is thereby diminished, but less than the expansion of the glass, which, being increased in length, makes the mercury, which occupies a less proportion thereof, appear to descend. This, however, is so small a quantity as not to be easily perceived; and we suspect, that the effect observed by our correspondent, was the result of some imperfection in his instrument. If any portion of air should be contained in the tube above the mercury, the expansion of that air would produce the effect described. To discover whether there is any air in the tube, it must be reversed, and if there is, a bubble will be seen at the end of the tube.—Ed.]

ON ALKALIES.

(Continued from page 220.)

Aricina (Vegeto).—This was discovered by Cerial in 1829, in a bark which had been used to adulterate cinchona. It much resembles cinchona in its outward character, but differs in its chemical qualities. When pure, it is nearly tasteless; but, when dissolved in acids, is extremely bitter. It is decomposed by concentrated nitric acid, and, with it, produces a green colour; but, when the acid is very dilute, a colourless nitrate is obtained. According to the analysis of Pelletier, it is composed of

Carbon	70.9
Oxygen	13.9
Hydrogen	6.9
Nitrogen	8.3
	100.0

Atropia (Vegeto.)—This alkali exists in the plant called the deadly nightshade. It is obtained from the root after it has been dried, which yields only one-three-thousandth of the pure alkali. It is soluble in ether and anhydrous alcohol, and in 500 parts of water. It forms definite compounds with acids, which are decomposed by potassa and ammonia; when heated with potassa, it is decomposed, and yields ammonia. According to Dr. Liebeg, it is composed of

Carbon	68
Hydrogen	26
Oxygen	12
Nitrogen	1
	107.

Baryta or Barytes (Earthy).—This alkaline earth is the oxide of barium. It consists of

Barium	89.7
Oxygen	10.3
	100.0

To obtain pure baryta, take the native carbonate and reduce it to a powder; then dissolve it in nitric acid (diluted), and evaporate the solution till crystals be formed; then calcine them in a China or platina crucible, for at least an hour, at a dull red heat; then suffer the vessel to cool, and transfer the whole of the contents into a stopped bottle. This is pure baryta; it is of a bluish colour; fusible only at the jet of the oxyhydrogen blowpipe; has a sharp caustic taste; corrodes the tongue, and all animal matter; is exceedingly poisonous; has a very powerful alkaline reaction. Its specific gravity is 4.0. When sprinkled with water it becomes hot, and slakes violently, falling into a fine white powder, called the hydrate of baryta, which contains 10½ per cent. of water. Baryta unites with phosphorus, which compound decomposes water rapidly; it also combines with sulphur. Baryta is soluble in twenty times its weight of cold water, and twice its weight of boiling. It may be crystallized. Of all the bases, baryta has the strongest affinity for sulphuric acid, and hence it is employed as a

test for that acid. The only use of this alkaline earth in commerce, is to adulterate white lead; the dealers use the sulphate of baryta or heavy spar.

G. Piesse.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 92.)

Towcester is a market town in Northamptonshire, about five miles and a half west of the railway. It was a fortified town of considerable strength in the time of the Saxons, and resisted for a long time the attacks of the Danes; but it seems to have been ultimately overpowered, for in the year 921, King Edward issued a mandate ordering Towcester to be rebuilt and fortified. In Doomsday Book, the name of this place is spelt *Tovecestre*, which signifies a fortified city on the river Tove. It is situated on the ancient Roman way called Watling Street; and, from the number of Roman coins which have been dug up in the neighbourhood, it has been supposed by some antiquarians, that the Roman station called Lactodoro was on this spot; but others contend that it was at Stoney Stratford, which is also on the Watling Street. Towcester, as at present existing, consists principally of one long and spacious street. The church, dedicated to St. Lawrence, is a neat erection of the eleventh century; it contains a monument erected to the memory of Archdeacon Sporme, who founded a college and chantry in the town in the reign of Henry VI. Pope Boniface VIII. was incumbent of this church at the time of his elevation to the pontifical chair in 1294. Sir Richard Empson, Chancellor of the Duchy of Lancaster in the reign of Henry VII., was the son of a sieve maker in this town; his extreme rigour and cruelty in enforcing the penal statutes so exasperated the people, that Henry VIII. found it expedient to yield to the universal cry of indignation, and he was tried at Northampton, and beheaded August 16, 1510. Silk and lace are manufactured here; the latter in considerable quantities, both in the town and in the neighbouring villages. A market is held on Tuesday.

The Roade Station, 60 miles from London, 52¼ from Birmingham. At this place a great difficulty presented itself in the construction of the line of road; it was necessary to pass through a range of hills called the Blisworth Ridge, composed of rock, and extending a considerable distance. The Grand Junction Canal is carried through by means of a tunnel 3080 yards in length, about a mile distant from the railway, and nearly parallel to it. The railway was constructed by blasting the rock and filling up the hollows with masonry.

Blisworth Station is an intermediate one, 62½ miles from London, and 49¾ from Birmingham. Blisworth is situated on the road from Towcester to Northampton; a lofty viaduct carries that road over the railway. Emerging from the Blisworth cutting, a view of the Nen Valley is obtained; and the railway continues by alternate cuttings and embankments through Stowe tunnel, 400 yards in length, to

Weedon Station, 69¾ miles from London, and 42½ from Birmingham. This is the nearest principal station to the important town of

Northampton. The obstinate and ill-advised opposition of the corporation of Northampton and some of the neighbouring gentry, to the original plan of the Railway Company, was a great impediment to the progress of the undertaking, and caused an additional expenditure, estimated at not less than 500,000*l.* They now expiate their folly and illiberality by unavailing lamentations, for the loss they so wilfully and eagerly brought upon themselves, by opposing the passage of the railway by a route which would have passed close to the town. Northampton is connected with many important historical events, and numerous councils and synods have been held there. A destructive conflagration consumed the greater part of the town in 1675, when above 600 dwelling-houses were destroyed, and a greater number of families consequently deprived of their habitations and property, and many were reduced to great distress. A liberal subscription, however, soon enabled the inhabitants not only to rebuild their houses, but to raise from the ruins a far superior and handsomer town than the old one.

ANOTHER MECHANICAL AND CHEMICAL SOCIETY.

To the Editor of the Mechanic and Chemist.

Sir,—I should be happy to join a society for the study of chemistry and mechanics, if situated in the neighbourhood of Bishopsgate or Shoreditch. I am so limited to time, as will not permit my attendance at any great distance. I have, therefore, great pleasure in stating, that there is a large room, situated in Shoreditch, that can be had for such a purpose without any expense; and there are a few juveniles

residing in this locality, that would willingly join such a society. If you will do me the favour to give publicity to this suggestion, and if any of your readers are disposed to avail themselves of this offer, and unite with me in the formation of such a society, a line addressed to me will be duly attended to.

I remain yours, &c.,

R. SMITH JEFFS, jun.

81, Shoreditch, London.

To the Editor of the Mechanic and Chemist.

SIR,—Having received on Tuesday a letter from "Tyro Chemicus," stating that a meeting would be held at 37, Sussex Street, Tottenham Court Road, on Wednesday the 26th, for the purpose of forming a Mechanical and Chemical Society; I accordingly went to the above-mentioned place, where I saw a gentleman who stated himself to be Mr. Clark, and he expressed his surprise when I told him I had come there for the purpose of attending a meeting, and said he had not received any communication from "Tyro Chemicus" to that effect, or he would have prepared for it. I write to you, Sir, hoping you will allow this a place in your pages, not knowing whether a letter addressed to the Essex and Temple Coffee-house as usual, would meet the eye of "Tyro Chemicus," who will, no doubt, be glad to give an explanation to the above, for the satisfaction of all parties concerned, through the medium of your widely circulated periodical.

I remain yours, &c.,

J. MITCHELL.

[We trust that this mistake (which we feel quite confident will be satisfactorily explained) will not deprive the Society of a worthy and valuable member; but we take the liberty of suggesting the expedience of communicating directly with the parties immediately concerned, when their address is known. "Tyro Chemicus" will receive a communication per post.—ED.]

MISCELLANEA.

THE HIMALAYA MOUNTAINS.

(From Major Lloyd's Narrative, &c.)

MANY of the mountains around Semla, which are the mere vassals of the mighty Himala, would be the boast of other countries—as Wartoo or Huttoo 10,673 feet, Jungala between 10,000 and 11,000 feet, the larger Shallee 9,623 feet, the Choor Pahar 12,149 feet, and Jukko 8,120 feet. Over these the snowy range extends from N. 30 deg. W. to N. 70 deg. E., embracing consequently an angle of 100 degrees. The general appearance of this mass of snow is that of a wide undulating plain, from which peaks rise in every imaginable shape. Their general height is from 16,203 to 25,749 feet, from 1,000 to 10,000 feet of which is covered with eternal whiteness; the disputed line of perpetual snow on the southern side of this first high chain being 15,000 feet. Between these peaks are the Passes which lead into Koonawr and Chinese Tartary, the principal of which are those nearest to us—as the Shatool 15,555 feet, the Yoosoo 15,877 feet, and the Boorendo 15,171 feet. This first barrier, however, is but the screen to other assemblages of higher mountains, which again are still the inferiors of the world-like bulwarks on the left bank of the Indus, from whence they slope to the Steppes of Tartary, and are at length lost in the immeasurable deserts of Cobi, and the deep woods and countless marshes of Siberia. The summits of this highest range have been estimated, upon good grounds, by my most adventurous and intelligent friends, J. G. Gerard and A. Gerard—who alone have explored many portions of these wild recesses—to rise to the enormous elevation of 30,000 feet. Within these towering bounds, the general appearance of the region is mournful and barren. There, surrounded by the most gigantic pinnacles of the universe, Sublimity sits fettered to Desolation. It awes the mind.

Land Slip.—A singular occurrence is related to have taken place near Salins, in the district of the Jura, on the night of the 29th-30th of January. A mountain, called the Cernans, has come down in mass on the plain by which it was surrounded, and a portion of the royal road from Dijon to Portalier has sunk with this great landslip, to a depth of more than 50 metres. That portion known as the *Rampe de Cernans* (the ladder or staircase of Cernans) is rendered impassable, and all communication between Cernans and the border of the Doubs is cut off. During the day of the 30th, a fresh mass of earth and rock detached itself, and slid down with a motion sufficiently rapid to be distinctly perceived at a great distance by the naked eye—displacing in its fall an additional portion of the road. It was apprehended that the mischief might spread much farther, and the conjectures were various as to the cause of the disaster. By some, it was attributed to cuttings made at the foot of the mountain for the formation of a new road; others were of opinion that a fountain, which ceased to play upwards of five-and-twenty years ago, must have taken a subterranean direction, and mined out a portion of the mountain. Happily, no lives have been lost.—*Athenæum.*

Cooking in the Seventeenth Century.—In "May's Accomplished Cook," published in 1685 (and quoted in the "Pictorial England"), is the following curious account of the *cuisine* of that period:—*Receipt to make a Herring Pie.*—Take salt herrings, being watered, wash them between your hands, and you shall loose the fish from the skin; take off the skin whole, and lay them in a dish; then have a pound of almond paste ready; mince the herrings, and stamp them with the almond paste, two of the melts or roes, five or six dates, some grated manichet, sugar, sack, rose water, and saffron; make the composi-

tion somewhat stiff, and fill the skins; put butter in the bottom of your pie, lay on the herring, and on them dates, gooseberries, currants, barberries, and butter; close it up, and bake it; being baked, liquor it with butter, verjuice, and sugar. Sometimes, however, the dishes, though equally fanciful, were of a more refined character: thus we read of "an artificial hen made of puff paste," with her wings displayed, sitting upon eggs of the same materials, where in each of them was enclosed a fat nightingale, seasoned with pepper and ambergris The same artificial taste prevailed in the preparation of the simplest materials of food. Butter, cream, and marrow, ambergris, all kinds of spices, sugar, dried fruits, oranges, and lemons, entered largely into the composition of almost every dish. Several articles also appear to have been dressed that would scarcely find admission into a modern English kitchen—such as snails, which were stewed or fried in a variety of ways with oil, spices, wine, vinegar, and eggs, and the legs of frogs, which were dressed into fricasses. On some occasions, therefore, a coarse and clownish dish was a pleasing variety. In the year 1661, a gathering of marquises, lords, knights, and squires, took place at Newcastle, to celebrate a great anniversary, when, on account of the number of guests, each was required to bring his own dish of meat. Of course it was a sort of competition, in which each strove for pre-eminence; but the specimen of Sir George Goring was reckoned a masterpiece. It consisted of four huge brawny pigs, piping hot, bitted and harnessed with ropes of sausage, all tied to a monstrous bag pudding.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 12, the Rev Dr. Vaughan, on Ancient Egypt. At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 10, Hugh Murray, Esq., on European History. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 10, Dr. Cautor, on the Nervous System. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street—Monday, March 9, the Rev. William Vidler, on the Natural History of Mammalia:—Flesh-eating Animals. At half-past eight precisely.

QUERIES.

Can any of your correspondents inform me where I can purchase a small cheap seraphine, or the notes of one—not the keys? S.

The process of stuffing birds? J. B. L.

How to melt brass with a common fire, and what would be most proper to cast it in? C. J. A.

How to make varnish for prints and maps? How to make rice glue? E. L. L.

[Every variety of varnish has been described in the "Mechanic." Dissolve gum copal in spirits of wine; or if that is too dear, take gum mastic, or any other you please.—Ed.]

1. How to make a bottle-jack? 2. How to make Venice turpentine? 3. How to make the apparatus for elliptic turning? 4. How to make marble paper? E. Lenger.

How to take the outer skin off bladders, so that, when filled with hydrogen gas, they will ascend like a balloon? J. P.
Birmingham.

Can any of your correspondents furnish me with the ingredients and process employed in what is called "gum-sugar boiling," such as barley-sugar, sugar canes, &c.? I am unable to produce that hard glossy substance employed for their formation. The more I boil loaf-sugar, the less the particles seem to adhere, and ultimately the whole becomes a dry powder. Also, the name of some good cheap work on sugar-boiling, as I am afraid those I have consulted are not to be depended on. A. E.
Birmingham.

The best method of dying silk crimson, blue, and purple; and also discharging colours for dying? E. Wort.

A few weeks back I got the machine into order, and charged the jar; directly after which I got the cat to put one of her feet to the jar, and with the other touched the ball, when I could see she had received a severe shock; the next day the cat was noticed to be rather bad, and every day got worse (it seemed as if she had got the lock-jaw, and could not eat anything, and scarcely drink), and at the end of eight days the cat died; what should you think was the cause of her death?—At what rate does a small balloon about one foot and a half diameter travel, and the longest distance it is supposed to go?—What is the longest time it is before bursting, and what weight it will carry? Mercer.

The receipt for making a much approved ink called magnum bonum? Wm. Conquest.

Being in want of a small seraphine, and having by me an electrical machine with apparatus complete; also two excellent compound microscopes that I wish to dispose of; perhaps among your numerous readers I may find one with whom to effect an exchange. Should this meet the eye of anyone so disposed, a letter addressed to "G. S., care of Mr. Puttock, Newsvender, 26, Grafton Street, Soho," will reach me. O. C. R.

1. Does the vinous fermentation always precede the acetous fermentation; or, can the latter take place without the former? 2. Is the cream of lime used by coal-gas manufacturers, for the purpose of abstracting carbonic acid from the carburetted hydrogen, or to abstract carbon? 3. By what means must the flow of oxygen through an Argand burner be regulated, so that no gas pass through but what is absolutely necessary in using the Bude light? 4. How many feet of gas per hour should an Argand burner, half an inch wide, consume of oxygen, for the above?
An Amateur Chemist.

1. The best method of refining oils, such as gallipoli, rape, and seal?—2. What proportions of water and acetic acid would make vinegar equal to strength 18°, and how to colour it? 3 How to make the best Prussian blue?

H. W.

The method of making, and the ingredients contained in lozenges? CONFECTIO.

The best means to prevent the back of the hands from chapping? A. S.

ANSWERS TO QUERIES.

To take Stains out of Mahogany.—Stains may be taken out of mahogany by spirits of salt (muriatic acid).

"C. G. Sidney." Lead is the most durable in the open air, but is more expensive than zinc.

To make Iron Cement.—Take of sal ammoniac, two ounces; sublimed sulphur, one ounce; and cast-iron filings, or fine turnings, one pound. Mix them in a mortar, and keep the powder dry. When it is to be used, mix it with twenty times its quantity of clean iron turnings or filings, and grind the whole in a mortar: wet it with water until it becomes of a convenient consistence, when it is to be applied to the joint: after a time it becomes as hard and strong as any other part of the metal. A cement that will resist the action of boiling water and steam, may be made by mixing boiled linseed oil, litharge, and white lead, mixed up to a proper consistence, and applied to each side of a piece of flannel or linen, and then placed between the plates before they are joined.

E. LEDGER.

To make Transparent Soap.—Heat together equal parts of tallow, soap, and alcohol. The heat applied to effect the solution should be as slight as possible, to prevent evaporation of the spirit. The solution being effected, must be suffered to settle; the clear liquid is then to be drawn off into the frames of the form desired for the cakes of soap. It does not acquire its degree of transparency till a few weeks' exposure to dry air. G. W. S. PIESSE.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the* "MECHANIC AND CHEMIST" *is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half a Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half a Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press,* 1, *Long Lane, Aldersgate Street.*

R. S. L.—*We shall be glad to see his treatise, and, if approved, it will be inserted.*

S. W. B.—*The cause of a liquid rising in an inverted cup when heated and allowed to cool, is the contraction of the internal air at the lower temperature, which renders it no longer capable of resisting the external pressure.*

A Country Mechanic.—*There appears to be a mistake in the name of the inventer of the velocipede referred to; instead of "Ritchie," it should probably have been "Revis" (See page 177, No. XV. N. S.) We should like to see the plan proposed by our correspondent. Advertising the prices and places of sale of books, would subject us to the advertisement duty; it is for this reason that the prices of books are never mentioned in reviews. We have before stated, that this kind of information may be obtained at any bookseller's.*

Manipulator *wishes to obtain a situation in a laboratory, or any chemical establishment. We cannot publish his address, but it may be obtained by application at our office.*

W. Scott.—*The north pole of a magnet attracts the south pole of another magnet; but two north, or two south poles, repel each other. Both the north and south poles attract iron; and in the powerful magnets called "horse-shoe magnets," the two poles are brought together by bending the magnetized bar. If a piece of loadstone be immersed in iron filings, it will be found, when taken out, to be covered all over with particles of iron; at two opposite points they will stand erect, and these are the poles; in the intermediate parts they will incline more and more, till at the point which is at equal distance from the two poles, they will lie down flat on their sides.*

W. W.—*A brief account of the system of short-hand, which he has successfully practised, would, we should think, be acceptable to many of our readers. Our correspondent being a good mathematician, as well as a sound logician, we feel convinced that his explanations and his reasoning will be alike clear and accurate. The diagrams may be accurately executed in wood; but the figures should not be too small and crowded.*

E. L. L.—*The pistons of air-pumps are usually formed of circular collars of leather. We are not aware of any other substance being more convenient, or in any respect better suited to the purpose.*

F. P. H. Truman *will find that we have made an arrangement to obviate the inconvenience he complains of. It is not in our power to do anything to forward his views respecting the machine for cleaning knives, unless he wishes his invention to be made public, or states upon what conditions he is willing to reveal his secret.*

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THE

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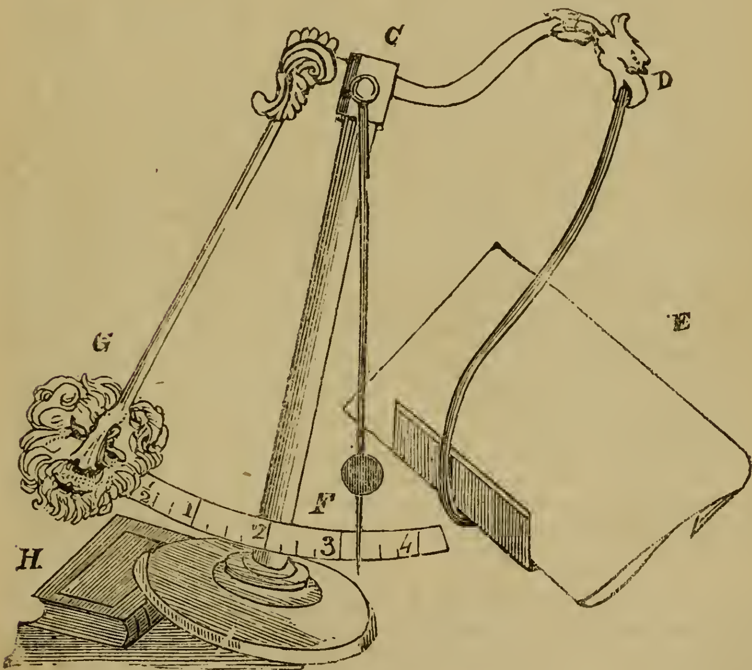
RADCLIFFE'S IMPROVED SELF ADJUSTING METROPOST.



 City Press, 1. Long Lane, Aldersgate Street : D. A. Doudney

RADCLIFFE'S IMPROVED SELF-ADJUSTING METROPOST.

(See Engraving, front page.)

Since the establishment of the new postage system, a multitude of models have appeared, all pretending to some superiority either in accuracy or in rapidity of operation, above an ordinary scale. But however ingenious many of them may be, it does not appear that any of them are considered satisfactory by the Post Office authorities; and it is probable that no self-adjusting scale will be permanently adopted, where expedition is so important an object as it is at the Post Office. In an ordinary scale adjusted for any given weight, it is seen immediately whether the object to be weighed preponderates or not; but in a self-adjusting scale, at least in all those which have hitherto appeared, it is necessary first to wait till the vibration has subsided, and then to examine a scale and index, in which last operation an error is very likely to occur. Mr. Radcliffe's metropost is by no means exempt from these objections; but it possesses an advantage above all others that have been offered to the public, and that advantage seems likely to render it of great utility, and of far more extensive application than the weighing of letters. This machine will indicate the accurate weight, without being placed in a true perpendicular position, as is requisite with other self-adjusting scales. The engraving (see front page) represents the "metropost," thrown out of perpendicular by an obstacle, H, on which one side of the foot rests; E is the letter, suspended from the point, D, of a beam, which moves about the centre, C; G is a weight fixed to the index, and the beam, C; D and F, is a weight *suspended* from the centre, C; so that the angle, G C F, is equal in all positions of the machine, and, consequently, the true weight is always indicated.

LOCOMOTIVE STEAM-ENGINES.

At the last meeting of the Institution of Civil Engineers, Mr. J. Parkes presented a communication on the subject of steam engines, from which the following is an abridged extract from the report in the *Athenæum*:—

"The locomotive differs from the fixed non-condensing engine only in the use of the blast, and the same method of measuring the effects of the steam are applicable to both. Experimenters on the locomotive have generally attempted to determine the amount of resistance opposed to its progress, in preference to ascertaining the power expended in overcoming the resistance. The exact solution of either of these questions would furnish all that is wanted; but the ascertaining the total resistance by an analysis of its several constituents, is attended with great difficulties, as the forces to which they are to be referred are so exceedingly numerous and variable, that the assigning the exact value to each at any one velocity, has hitherto eluded the talents of those who have pursued this method. M. de Pambour was the first analyst whose labours will require attention. The results given by this author in his practical treatise on Locomotive Engines on Railways were compared by Mr. Parkes, with the results which he had obtained when experimenting on an engine of precisely a similar character, and discrepancies presented themselves which appeared totally irreconcileable. These and other circumstances led the author to consider, whether the resistance to traction would properly be deduced from the laws of gravitation, or whether any certain results would be derived as to the amount of resistance on a level, from observations on engines and trains moving down inclined planes. The great object seemed to be, to discover some criterion of the mechanical effect produced by a locomotive at all velocities, which would apply as practically and as distinctly to a locomotive, as duty to a pumping engine, or horse power to a rotatory engine. If this were possible, it seems of far less importance to distinguish the precise value of each particular unit of resistance, than to determine the relative sum of resistance, and the relative expenditure of power at all velocities and under all circumstances. Now the term duty may be applied, in the strictest sense of the term, to the work done by a locomotive engine; for whether the engine drag a load, whose resistance is 8 lb. per ton, or whether a weight of 8 lb. for each ton of matter moved, descending over a pulley and attached to the load, be considered as the moving force, the result is the same. If, then, the tractive force or resistance per ton of matter in motion, which is the real load on the engine, be ascertained, the whole effect is found by multiplying this sum by the space passed over in feet; and the consumption of water as steam, and of coke, being known, we have all the elements requisite for determining the duty performed by the steam or coke. The pressure against the pistons may be deduced from the sum of the resistances first calculated on the assumed resistance over-

come at the velocity of the engine in each experiment; and the pressure on the pistons may also be deduced from the ratio of the volumes of the steam and water consumed."

The results of numerous experiments obtained on these principles, are detailed in a tabular form; and, in another table, the same experiments are reduced to terms of horses' power, exhibiting the absolute power resulting from the steam used, that required to overcome the assigned resistance, and the power which balances the effective duty; and the author arrives at the conclusion, that they are inconsistent with locomotives.

"A condensing engine, placed on wheels, with water of condensation transported for its supply, and made to drag a train along a railway, would require the same expenditure of water in steam, to produce a given effect, as if fixed. A non-condensing engine, also, is one and the same machine, whether fixed or locomotive, excepting that the latter must consume more power than the former, to do equal work, at like pressures, by the amount of the additional resistance arising from the contraction of its eduction pipes, in order to produce a fierce blast of steam through the chimney. From these and other causes, the fixed non-condensing engine must be the more economical of the two; but if the results derived from M. de Pambour's data be correct, we must acknowledge the fixed non-condensing engine, with its simple atmospheric resistance, to be far inferior in economy of steam to the locomotive, with its plus atmospheric resistance. The experiments by Dr. Lardner were made for the purpose of determining the resistance opposed to progressive motion on railways. They consisted in dismissing trains at various speeds from the summits of inclined planes, and in observing their velocity when it became uniform; the resistance at such velocity being equal to the accelerating force of gravity down the inclined plane. The results of these are tabulated in the same manner as the preceding, and the most singular discrepancies present themselves. For instance, it would appear, that in one particular case a duty of double the amount of that effected by the condensing engine, was performed by an equal expenditure of power; that, compared with a fixed non-condensing engine at equal pressure, the locomotive, though labouring against the heavy counter-pressure of the blast from which the other is free, is assumed to have performed equal work with less than one-half the expenditure of power. That if the resistance assigned by Dr. Lardner, as opposed to the progressive motion of the train be correct, the efficiency of the steam in the locomotive, is more than double that obtained by the best condensing engines; more than treble that derived from stationary non-condensing engines, and equal to the performance of a Cornish expansive engine, doing a fifty-million duty with a bushel of coals. With such results before us, the resistances assigned as opposed to, and overcome by the locomotive at different velocities, must be regarded as utterly inconsistent with reality, and as resting on no solid foundation. The preceding results show, also, that errors have crept in by the adoption of the theoretical method of reducing undulatory surfaces to a level. M. de Pambour extends the length of the road as a compensation for the acclivities, or for the help afforded by the bank engines, and Dr. Lardner diminishes the time of the journey to that which he assumes would be occupied in performing it on a dead level. If the principles on which these corrections for the acclivities and declivities are made be correct, other facts than we are at present acquainted with must be taken into account, before it can be demonstrated that a given power will convey a given load, at some certain increased velocity, along a level compared with the actual velocity on any given undulating line. The resistances which enter into the composition of the sum of the forces, are ever varying to such an extent, that it may be doubted whether the theoretical level be not a pure fiction, with reference to the practical results of the experiment.

The effective power of a locomotive engine, or the excess of power, after overcoming its proper friction and the resistance from the blast, is solely expended in the generation of momentum. This, which is the product of the mass and the velocity, represents the useful mechanical effort exerted by the steam, and may always be ascertained under all the practical circumstances of railway traffic. The consumption of power as water, in the shape of steam, is a third quantity, which may also be readily ascertained. The application which may be made of the above data, is comprehended in the following propositions:—First, that equal momenta would result at all velocities from an equal amount of power expended in equal times by the same engine, if the forces opposed to progressive motion, and to the effective use of steam in the engines, were uniform at all velocities. Secondly, the difference

between the momenta generated by a unit of power in a given time, at various velocities, measures the difference in the sum of the resistances opposed to the power at those velocities. Having ascertained the gross weight of an engine, tender, and train—their mean velocity—and the expenditure of water as steam during the journey, simple computations will inform us of

1. The mechanical effect realized by a given power at all velocities.

2. The total increase or decrease of resistance at all velocities.

3. The ratios which the increase or decrease of resistance, at different velocities, bear to the ratios of those velocities."

Our limited space will not allow us to follow the author through his elaborate researches, but he is led to the conclusion, that the determination of the performance of locomotive engines by the methods he has set forth, is as practicable, exact, and demonstrative of their relative powers and dynamic excellence, as the determination of duty done by pumping engines. The intensity of the pressure on the opposite side of the piston arising from the blast, has been but imperfectly stated. By some, the discharge of the steam has been likened to a jet, and considered continuous. But an attentive observer can appreciate by his ear, that an interval exists between the alternate discharges of steam from the two cylinders. That these jets are periodic and not continuous, is also distinctly evidenced by the audible pulsations in the chimney, even at the very highest velocities of an engine, and their duration may be measured at lower speeds. Upon this intermittent action of the blast depend, in a great measure, the resultant pressure against the piston, and the production of a sufficient current of air through the fire, both which effects would be materially changed in intensity by the substitution of a continuous for a periodic current. The precise duration of the jet, or of the time of the steam evacuating the cylinder, can only be determined by direct and careful experiments; but its period may be ascertained within definite limits; for since a single discharge is completed within the time occupied by the piston in accomplishing a half stroke, and the pauses between two successive discharges are distinctly perceptible, a single blast cannot occupy the fourth part of the time of the revolution of the crank shaft, and very probably does not exceed the eighth part, or the period of a quarter stroke of the piston. Under no circumstances, then, can the pressure from the blast oppose the piston much longer than during one-fourth of the stroke. With an active pressure, then, of 30 lb. per square inch, the mean resistance from the blast would not be greater than $7\frac{1}{2}$ lb.; and with a pressure of 15 lb., not greater than $3\frac{3}{4}$ lb. per square inch, against the pistons. The author then proceeds to cite several observations and experiments made by himself, which are confirmatory of the preceding argument respecting the blast; and he was led conclusively to the fact, that one-fifth of the power of the engine experimented upon, at working pressures of 20 lb. and 15 lb., was absorbed in blowing the fire; and that the escape of the steam from the cylinder was four times swifter than the motion of the piston.

The author lastly treats of the expenditure of power for a given effect, by fixed and locomotive non-condensing engines. But few experiments on the expenditure of steam for a given effect, by non-condensing stationary engines, have been made. The relative consumption of fixed condensing and non-condensing engines, has been treated of by the late Mr. Charles Sylvester, of Derby, whose knowledge and accurate theoretical analysis of the subject are shown, by the close accordance of his conclusions with the facts established on two engines of these classes at certain working pressures. His conclusion, that the relative economy of these engines will be as the quantities of steam consumed, or as 1 to 1.72 at those pressures, is accurately confirmed by the results here recorded. Mr. Sylvester also showed, that by increasing the pressure upon the same non-condensing, and by enlarging the area of the condensing engine's cylinder and air pump, so as to maintain the steam in it at a uniform pressure per square inch for all loads, the economy of the former would gradually approach, and finally equal that of the latter."

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 226.)

THE CHEAPER METALS THAT HAVE IMPORTANT USES IN THE ARTS.

Manganese, Iron, Zinc, Tin, Lead, Copper, Bismuth, Antimony, Arsenic, Cobalt, Nickel, and Chromium.

MANGANESE.—28.

MANGANESE is a hard, brittle, greyish-white metal, resembling cast-iron, is soon tarnished when exposed to the air, and is not found in an uncombined state. The

compounds which contain it are chiefly the native or black oxide, which is a peroxide.

Peroxide of manganese is a black, hard, and somewhat brittle compound, containing 1 atom of the metal 28, and 2 of oxygen 16, making its equivalent 44.

By heat it gives up part of its oxygen, hence it is used for procuring this gas. When muriatic acid is poured upon this oxide, chlorine is evolved from the decomposition of the acid; hence large quantities of this oxide are used in the preparation of chlorine, for the purposes of bleaching and preparing the chloride of lime. It is used in small quantities in glass-making, to remove the green or yellowish colour; but in larger proportions it communicates a purple colour. The specimens of purple glass, such as the hyacinth glasses, are coloured by this oxide. The black glazing on earthenware, sometimes called black earthenware, is coloured by the same material.

IRON.—82.

Iron is the most useful and most abundant of all the metals; indeed there are few minerals in which its presence cannot be detected. It is the hardest and toughest of all the useful metals; hence its indispensable use in making agricultural and cutting instruments. Should the art of working iron be lost, there is no metal that could supply its place, especially for implements of cutlery. Its hardness may be very much increased by being heated and suddenly cooled. By heating it to redness, it is remarkably soft and pliable, and may be intimately incorporated or welded with another piece of red-hot iron by hammering, a property possessed by no other metals except sodium and platinum. Iron has the specific gravity of 7.7, and when pure it is nearly infusible; but, when combined with carbon, it melts at a bright red heat. It is attracted by the magnet, and may be rendered permanently magnetic; a property of the highest importance to man, which is possessed by no other metals except cobalt and nickel.

The ores of iron that are wrought for obtaining the metal, are the oxides, which are exposed to a high heat in a furnace, mixed with charcoal and lime. The charcoal takes away the oxygen, and a small portion of it unites with the metal, rendering it fusible. The lime at the same time uniting with the impurities of the ore, forming a fusible compound called *slag*, which floats on the surface of the melted metal, and prevents it from being oxidized by exposure to the atmosphere. The particles of metal at the same time, as fast as reduced, run down into the lower part of the furnace, where it is drawn off through a small aperture, previously closed with a plug of clay.

The iron thus obtained, is the common cast-iron, of which iron pots, kettles, stoves, &c., are made. It consists of about 5 per cent. of carbon, and contains many impurities, such as earthy substances; by heating repeatedly and hammering it, the carbon and impurities are separated, the metal is drawn out into bars, and is called wrought iron.

Steel is formed by placing in a kind of oven, alternate layers of bars of iron and charcoal in fine powder, and keeping the whole at a red heat for about a fortnight; the charcoal unites directly with the iron, of which it forms about one-and-a-half per cent. At a bright red heat it melts, is poured into moulds, and is then called cast-steel. It is used for the finest instruments.

Iron has a strong affinity for oxygen. In dry air it suffers no change, but when moisture is present, it is rapidly oxidized or rusted; but when heated to redness in the open air, it is converted into black scales, called the black oxide of iron; and in pure oxygen it burns with vivid scintillations.

Oxides of Iron.—Iron combines with oxygen in two proportions, forming the protoxide, which is dark, or nearly black; and the peroxide, which is red, and more commonly called iron rust. The latter is considerably used in the arts. It is used by the silversmiths for polishing their metals, under the name of rouge.

There is a golden-yellow mineral that is taken by the uninformed for gold; it is a sulphuret of iron, often called pyrites; it is very hard, and may be made to strike fire with steel. This mineral is used in preparing copperas, which is the sulphate of iron.

ZINC.—33.

Zinc, or spelter, as it is sometimes called by the workmen, is obtained from an ore called calamine, which is a native carbonate, or from the native sulphuret called zinc blende. The metal is procured by heating the ores with charcoal.

Zinc is a bluish-white metal, of a strong metallic lustre. It is a hard and brittle metal, and has the specific gravity of about 7. Though at common, and at high temperatures, it is brittle, between 212° and 300°, it is both malleable and ductile, and is rolled out into thin sheets, which are considerably used for covering the roofs and floors of buildings.

Zinc is used for making the zinc plates of galvanic batteries. But by far the

largest quantities are used for melting with copper to form brass.

Zinc undergoes little change by exposure to the air and moisture; but when heated to redness in the open air, it takes fire and burns with a bright white flame, forming an exceedingly light oxide, which readily floats about in the atmosphere. This oxide was formerly called, from its lightness, white nothing, philosopher's wool, &c. It is now called oxide, or flowers of zinc.

SOLUTION OF PROBLEM.

To the Editor of the Mechanic and Chemist.

SIR,—May I beg you to insert an omission which appears in the solution of the problem which I sent you last week:—

$$\text{Given } (x+1)\,.\,(x^2+1)\,.\,(x^3+1)=30\,x^3.$$

$$\text{Multiplying, we have } x^6+x^5+x^4-28\,x^3+x^2+x+1=0;$$

And this is divisible into factors $x^2-3\,x+1=0$, and $x^4+4\,x^3+12\,x^2+4\,x+1=0$.

The first solved gives $x=(3\pm\sqrt{5})\div2$. The latter is also solvable by quadratics, for it is equal to $(x+1)^4=-6\,x^2$; or, $(x+1)^2=\pm\,x\sqrt{(-6)}$.

$$\text{Hence } x=\frac{\pm\sqrt{(-6-2)}\pm\sqrt{(-6\pm4\sqrt{-6})}}{2}$$

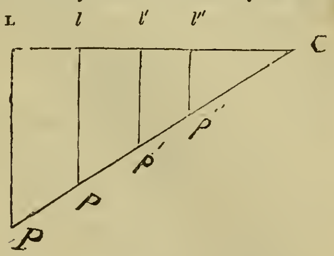
I remain yours respectfully,

J. YATES,
8th Batt. Roy. Artil.

ANSWER TO QUESTION IN No. 68.

QUESTION.—A, a pedestrian, is benighted on a large plain, and observes a light bearing directly north from him, and which light is distant from him exactly one mile. The light is carried by B, travelling directly east, at the rate of three miles an hour; but A, erroneously supposing it to be stationary, keeps continually travelling towards it at the rate of four miles an hour. How long will he travel before he comes up with B, and what will be the distances travelled by each of them, from the time the light appeared? Also, required the nature and construction of the curve described by A's route?

Ans.—Let P = pedestrian, L = light, and C = the point of meeting. Then, since the motion of each of them is uniform, the distance travelled by either of them in any time will directly be as the



distance travelled in all; that is, P p : L l :: P C : L C :: P C : l C :: 4 : 3; therefore, the line joining them always points directly north (for $p\,l$ is parallel to L P by the 2.6. Euclid). Again, the distance from each other decreases directly as the distance from the place of meeting decreases; that is, C L : L P :: C l : $l\,p$ :: C l' : $l'p'$ :: C l'' : $l''\,p''$; and that being the case everywhere, the line P C must be a straight line, since L C is one.

Their length may thus be found:—

$$\text{Let L C}=x;$$

$$\text{Then we have } 3 : 4 :: x : \frac{4x}{3}=\text{P C}.$$

$$\text{But } \frac{16\,x^2}{9}=x^2+1, \text{ or by reduction and transposition, } 7x^2=9;$$

$$\text{Or, } x^2=\frac{9}{7}\ \therefore x=\frac{3}{\sqrt{7}}=\text{L C};$$

$$\text{And } \frac{\frac{12}{\sqrt{7}}}{3}=\frac{4}{\sqrt{7}}=\text{P C.}$$

L. L.

Improvement in Glass-bottle Blowing.—Messrs. Coutures, Brothers, of Bordeaux, glasss blowers, have just introduced an important improvement into the art of blowing black or bottle glass, by using a flexible tube, worked by machinery, for injecting air into the parcels of fluid metal, instead of letting their men continue to blow them by mouth. An ingeniously-contrived cock allows them to consume just as much, or as little air as is wanted. These gentlemen have declined taking out a patent for their invention, and, in a spirited manner, have made it public.—*Hereford Journal.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, March 18, G. H. Bachhoffner, Esq., on Chemistry. Friday, March 20, G. Bennett, Esq., on Oratory and the Drama. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 19, R. A. Ogilvie, Esq., on Insects, At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 17, M. C. Gascoigne, Esq., on Switzerland. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 17, Dr. Cantor, on the Senses At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street.—Monday, March 16, the Rev. William Vidler, on the Natural History of Mammalia:—Flesh-eating Animals. At half-past eight precisely.

QUERIES.

S. C. H. wishes to know, in making wax flowers, what preparation can be put on previously to painting, to give the paint a soft appearance, and to prevent it from running off, which the greasiness of the wax causes it to do? I also wish to know of what ingredients those flowers are composed, which have a more transparent appearance than wax; and if they are put together with gum or any other ingredient, as I find the weather has not the same effect on them as on wax; and where the composition of which the flowers are made, may be bought, ready prepared?

The method of making and using black japan for furniture? The method I adopt at present is, by grinding a little colour in turps, and mixing with a little copal and white hard varnish; but I do not get that clear smooth surface the London japanners do. Also the name or title of a little work which is a guide to cabinet-makers in such matters? I think such a one was published some few years ago in London, but I do not know its title. R. H. S.

The best and cheapest method of making ginger beer that will keep in hot weather, with or without the use of yeast; without would be preferable, if it could be made fit for use in about two days, to be bottled in common ginger-beer bottles? O. W.

1. How to work out in figures the measurements of deals of different thicknesses; viz., 12 feet long, 11 inches wide, 3 inches thick; 11 ft. long, 9 in. wide, $2\frac{1}{2}$ in. thick, &c., so as to bring them to 2 inches, being generally sold in Liverpool at so much per foot of 2 inches; and also how to work out standard hundred of deals by figures. 2. A good and cheap work out, with instructions on writing commercial letters? 3. Also a cheap book on the harmony of colours? J. BANKS.

ANSWERS TO QUERIES.

Receipt for Black Ink.—Into a glazed stone jar or pitcher put one pound of Aleppo galls bruised, then add one gallon of rain water nearly of a boiling heat; let these stand together for fourteen days upon the kitchen hearth; then add green copperas, or sulphate of iron, four ounces; four ounces of logwood chips, one ounce of alum, one ounce of sugar-candy, and four ounces of gum-arabic; let the whole remain ten or twelve days longer in a moderate heat, the mouth of the vessel slightly covered with paper; stir the ingredients with a stick twice a day during the whole time, then strain and bottle; pour a little brandy on the top of the ink in each bottle, then cork them well, and keep them in a place of temperate heat. This ink may be depended upon as excellent, durable, and preserving the writing all a deep black. The best galls are those which are of a dark colour, heavy, and free from grub holes.

To make Printing Ink.—The following is Mr. Savage's receipt for making one pound of printing ink:—Take balsam of capivi, 9 oz.; lamp black, 3 oz.; indigo and Prussian blue, equal parts, $1\frac{1}{4}$ oz.; Indian red, $\frac{3}{4}$ oz.; turpentine and soap, 3 oz. This mixture is to be ground upon a slab with a muller, to an impalpable smoothness; a small quantity of acetate of lead accelerates its drying.

To obtain Skeletons of Small Animals.—The most easy way is by burying them for a few weeks, when the bones will be found beautifully cleaned by the worms. They have then to be fixed together by wire. A natural skeleton may be easily made by removing all the soft parts, macerating in water for a short time, and cleaning with a knife, so as to leave the bones attached by their own ligaments. J. J. F.

Zinc requires to be exposed to the action of air and moisture for a considerable time before the coating of suboxide becomes formed; while lead is very soon covered with carbonate by exposure.

Odell's System of Shorthand is very easy, and calculated for rapid writing. I do not know whether there is any system superior to it.

Method of Drawing an Epicycloid.—On the rim of a circular piece of wood, dovetail a black-lead pencil. Lay a rule, or straight piece of wood, upon a sheet of paper; place the circle against it, and roll it along; the point of the pencil will gradually ascend, and trace out a curve called the cycloid. If a hole be bored at any point within the circle, and a pencil slipped through, the curve produced will be the trochoid. If, instead of being rolled along a straight line, it be made to move round the outside of an iron ring, the curve generated by the pencil on the rim will be the epicycloid; by the pencil at the point within the circle, the epitrochoid. If the circle be rolled round the inside of the iron ring, the curve traced by the pencil on the rim, will be the hypocloid; that by the pencil within the circle, the hypotrochoid. If a piece of wire be twisted round the ring, and passed through the centre of the circular piece of wood, and the circle be made to revolve at the same time that the cen-

tre is sliding round the ring, then the curve, generated by the pencil at either point, will be the epicycle. If a loop be tied at the end of a reel of cotton, and the reel be held down upon the paper, then passing a pencil through the loop, and unwinding the thread, the point will describe the involute of the circle. It will be easily seen, that several of these curves are traced by the different parts of wheels, and the sun and planet arrangement of Watt. The involute of the circle is useful for toothed wheels, since the edges are longer in contact, by which means jarring or shaking is avoided. If a piece of string be doubled, and tied in a knot, so that it may be pulled into the shape of the letter O; it is evident that, upon slipping it over a nail, and drawing a pencil round in the other end of the loop, it will describe a circle. If the same string be passed over two nails at a distance from each other, and the pencil be drawn round as before, the curve produced will be an ellipse, or oval.

" T. P." may, perhaps, find this suit his purpose. The erroneous statement which I have made at page 198, I copied from Sir Richard Phillips's " Arts of Life," page 897, line 57. His words are, " Phosphuret of calcium, or phosphate of lime, is obtained in the following manner, &c." Pursuing chemistry only for amusement, and not having sufficiently attended to the *ums* and the *ates* and the *urets*, I supposed, as his words would lead anyone to suppose, that they were convertible terms. " G. Piesse " has my thanks for rectifying it, as it might mislead others as well as myself.

In " S. Rutter's " hygrometer, the scale is upside down. Cords swell, and, therefore, contract in wet weather; consequently, a moist atmosphere would lift the plummet, and a dry one depress it.

The best System of Shorthand.—I have been in the constant habit of writing one myself for many years, and have examined 20 or 30 systems. It is extremely difficult to say which is the best. The one I happened to learn is Blanchard's. The usual way of comparing them, is to count the number of marks required by each, to write out any portion of a speech, psalm, sermon, &c. I never remember to have seen Blanchard's praised. Gurney's has been much extolled. I have it lying before me at the present moment. Blanchard uses fewer marks; indeed fewer than any system I have ever examined, save one, which was written on intersecting lines. That I attempted to use for a year or two, but found it more trouble than it was worth. I have been enabled to copy sermons verbatim, that is, the manner in which shorthand writers understand the phrase, omitting the monosyllables, which may be afterwards easily supplied; but this is more the result of long practice, than the peculiar brevity of the system. Almost any system, unless, indeed, very bad, will enable a person, with continual practice, to write a great deal. In general, the best systems are those in which the letters of the alphabet consist of only one mark. As for any system enabling a person to follow a speaker in a few weeks, as the title pages of some of them announce—*credat Judæus Apella.* He may follow him by walking behind him, but not otherwise.

" Tyro Chemicus" will find a method described in the " Holiday Companion," by which he may cut himself glass cylinders from common vials.

" R. T." may also find a receipt for cheap black ink in the same little work.

W. W.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the* " MECHANIC AND CHEMIST " *is forwarded through the post two days prior to the date of publication, upon the following terms ; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half-a-Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half-a-Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press,* 1, *Long Lane, Aldersgate Street.*

The Mechanical and Chemical Society.—*We have received several letters complaining, that at the place appointed for the first meeting, no room was provided, and the person who convoked the meeting was not present. The following is offered in explanation by " Tyro Chemicus:"—*

" Having apprised all the gentlemen who had written to me, that a meeting would take place on Wednesday, the 26th of February, I then wrote a letter to Mr. F. Clark ; but, instead of posting it, I gave it, unfortunately, to a friend to deliver, on the Wednesday morning ; but he forgot it, and, consequently, this unpleasant mistake occurred, which Mr. J. Mitchell complains of, and for which I am very sorry.

TYRO CHEMICUS.

Any letter directed to me at Essex Street, Strand, will meet with immediate attention."

We are exceedingly sorry to find, that a very acrimonious quarrel between two of the members, should partially disturb the harmony which such laudable and pacific pursuits as those which are the objects of this Society might have been expected to secure. We trust that neither of the contending parties will blame us for denying publicity to their communications, and expressing a hope, that much as they may feel irritated at the present moment, a little cool explanation and friendly interposition may effect a reconciliation.

Our next will be a double number, and we shall be able to notice a great many correspondents who are unavoidably omitted this week.

London: Printed at " THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street. Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 82 & 83, NEW SERIES. | SATURDAY, MARCH 21, 1840. (PRICE TWOPENCE.) | Nos. 203 & 204, OLD SERIES.

COMBUSTION.

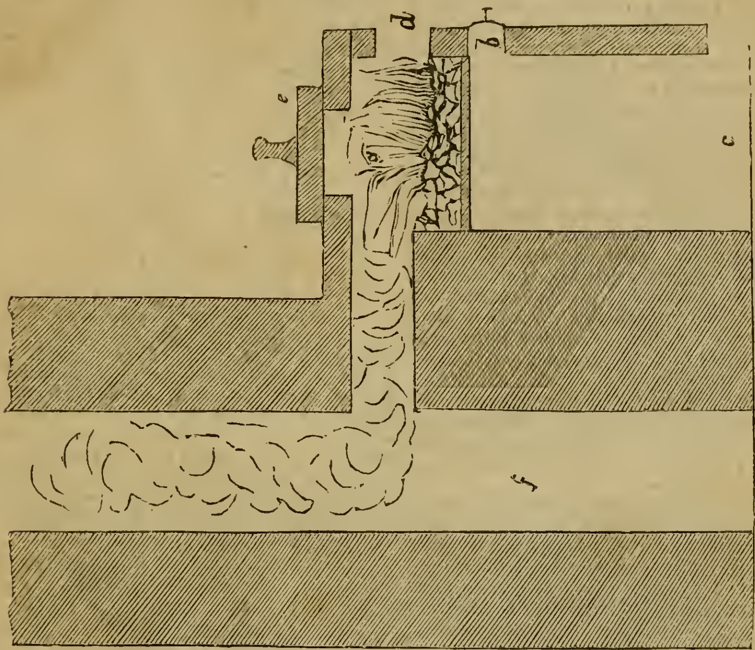


FIG. 1.

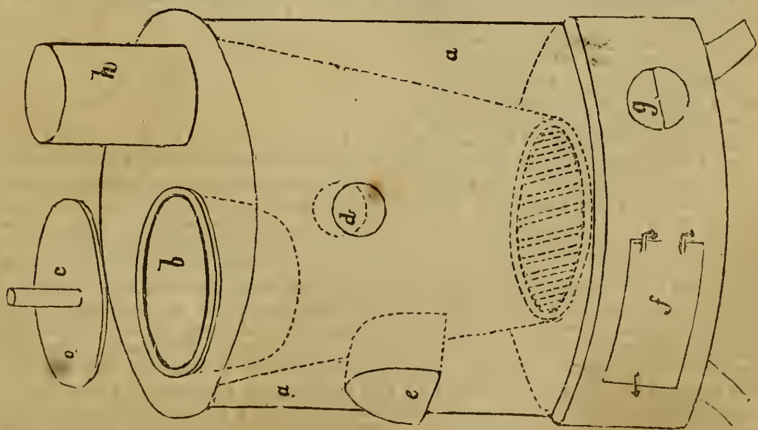


FIG. 2.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

ON COMBUSTION.

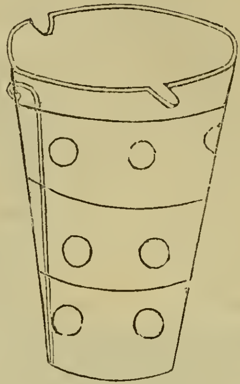
(Continued from page 233.)

In a common fire-place, heat is communicated principally by radiation, the smoke and consumed air ascending in the chimney. The less the quantity of metal, the greater the heat projected into the room. With large metallic bars and plates, a great quantity of heat is continually withdrawn by conduction, as the air which passes by them ascends in the chimney. Sometimes polished brass plates are used with advantage at the sides of particular fire-places, to reflect into the apartment any radiant heat which may fall upon them. Grates are almost invariably placed too high; and branders supporting the fire should be on a level with the floor, and the ash-pan sunk below them.

The term draught is usually employed in reference to chimneys; and when air passes through them quickly, they are said to draw well. The movement of the air depends, however, upon the colder and heavier air meeting with less resistance than before from the expanded and lighter air in the chimney; and the greater the difference between the specific gravity of the external air and that in the chimney, the more rapidly does the movement go on, or, in common language, the better does the fire draw.

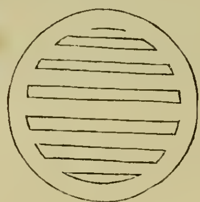
For a single furnace, perhaps, none will be found more generally useful than that represented in fig. 1, where *a* is the body of the fire, *b*, the draught-hole, and *c*, the ash-pit; both of which should be furnished with doors, so as to regulate the supply of air; *d*, an opening in front of the fire, useful in making different sorts of gases; it has also an opening at *e*, to introduce crucibles through; these also, should have covers, as represented in the engraving; *f*, the chimney. Another very useful and portable furnace, invented by Dr. Black, is represented in fig. 2, and consists of a case of stout sheet iron, lined to the thickness of two or three inches, with a very infusible clay, or earthy composition. *a a*, an iron pot, for a sand bath, is seen at *b*, with lid, *c*; *d*, is an opening to introduce tubes through; *e*, is the door; *f*, the ash-pan, and *g*, the valve to regulate the supply of air; the chimney, at *h*, may be connected by pieces of tubing. A very cheap and useful furnace for chemical purposes, may be made out of a crucible:—Take one twelve inches high and seven inches in diameter at the top, which may be obtained from a refiner of metals. It is sufficiently soft to be cut with a knife. In this four holes, each rather more than an inch in diameter, and situated at equal distances from each other, are to be made with a gimlet, and enlarged with a round rasp; and above them, two other rings of holes rather smaller, and arranged as represented in fig. 3. It is then to be bound

Fig. 3.



with soft iron wire, one-eighth of an inch in thickness; a piece to be first carried underneath and up the sides. Notches should be made to receive the wires, to prevent them slipping, and to keep the furnace in a firm position. Two small circular grates are next to be provided, of such a size, that one will drop between

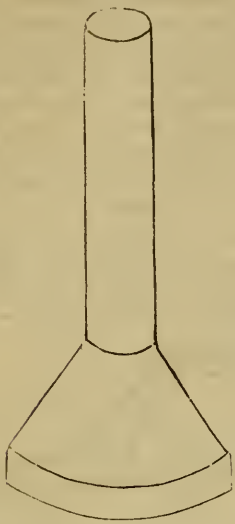
Fig. 4.



the two lower rows of holes, and the other between the two upper, by which the fire may be made deeper or shallower, as occasion may demand. Two notches may be cut at the top to receive a tube. The object in binding it with wire, is to hold it together when it cracks, which it is sure to do when heated; this, however, does not impair its efficacy, as may be inferred from the fact, that the writer has had one in use for five years. The fuel for this furnace is charcoal, and if a flue be applied, as represented in fig. 5, a white heat may be raised and sustained. With 20 or 24 bricks, and a few small slips of narrow hoop iron, a small furnace

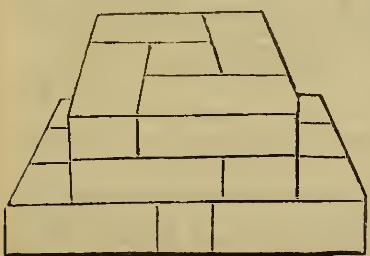
may be constructed in a few minutes, capable of giving a good red heat, where the

Fig. 5.



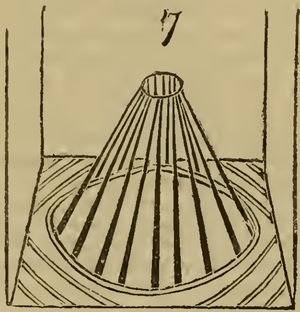
usual facilities for operating are not to be obtained, and where a common fire is not accessible. The bricks are to be placed as in fig. 6; slips of iron being placed in the

Fig. 6.



middle to support the fuel. If the bricks be laid with mortar or clay, the current of air will be still stronger, and the heat greater. An idea once struck me of forming a stove, the grate of which should come to a point, being in the shape of a cone; and I found that the heat, for the size of it, was very considerable, so that a piece of cast-iron, placed at the apex of the cone, was in a few minutes melted. The width of the inside was ten inches, and the widest part of the cone eight. It was lined with fire clay three inches in thickness, and yet I have sometimes seen the whole of it at a red heat. I found a great annoyance from the bars of the cone being so rapidly oxidized, though they were made of wrought iron. A sketch of the cone is seen in fig. 7. I also passed a gun-

Fig. 7.



barrel, lined at the outside with clay, through the body of the stove, and connected one end (by a piece of tubing) with the bottom of the stove, so that all the air which went to supply the combustion of the fire, had first to pass through the ret-hot tube: the heat was increased, but not to any great extent. I also tried the result of passing various gases through the tube, with very curious effects. I passed a current of steam through the fire, which greatly increased the heat. This fact is well known; and a very pleasing experiment is, to put a kettle on the fire, with a tube from the spout to the body of the fire; the kettle should only be about a quarter full, so that when the kettle begins to boil, the steam is forced into the fire, which makes it boil faster, and a greater quantity of steam is produced. Before concluding, I must add, that in all cases where a strong heat is required, all apertures leading into the chimney above the place where the fuel rests, ought to be closed, and any of the apertures leading into the chimney from any furnace not in use, must also be shut; otherwise cold air rushing in by them reduces the temperature of the warm ascending current, and, consequently, reduces the temperature in those furnaces in use, by preventing so rapid a consumption of the fuel.

All furnaces where a steady and regulated temperature is required, must be provided with ash-pit doors, by which a fixed and steady supply of air can be admitted and regulated, so as to produce a powerful or more moderate heat. But cutting off altogether the supply of air, the fuel may be kept unconsumed for a length of time. I must now conclude with

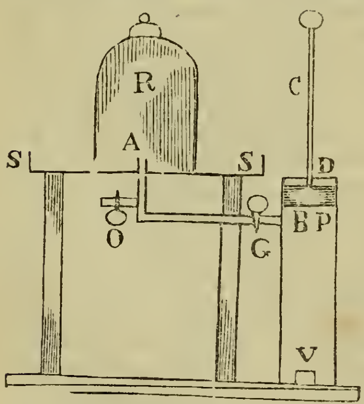
the words of the immortal Davy, "Without combustion, man might have wandered for ever, barbarous and uncivilized, in his native deserts. By the help of combustion, the artist and manufacturer fabricate the tools by which we erect cities, subdue and cultivate the earth, and directly derive our support. Assisted by combustion, commerce erects the stately vessel, subjugates the ocean, showers plenty over every nation, and connects mankind together. By the arts, dependant on combustion, science and philosophy, no longer confined to thinking individuals, exist in characters. The press has made them immortal, and will ever continue to extend their beneficial influence; and, lastly, aided by combustion, the sage devotes to philosophy the solitary hours of midnight, pursuing those combinations of ideas which, producing inventions, improve and ameliorate the condition of man."

FELIX WEISS.

Liverpool.

LEDGER'S AIR PUMP.

R is the receiver, having its lower edge ground smooth, so as to rest in close contact with a brass plate, of which S S is a section; in the middle is an opening, A, which communicates by a tube, A B, with a hollow cylinder, in which a solid piston,



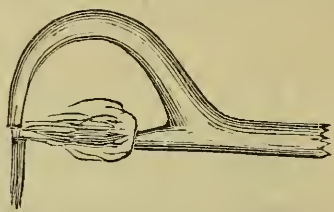
P, is moved; the piston rod, C, moves in an air-tight collar, D, and at the bottom a valve, V, is placed, opening outwards. When the piston, C P, is pressed down, and has passed the opening at B, the air in the barrel, B V, is enclosed, and will be compressed by the piston; it will, therefore, press downwards upon the valve, V, and the air in the barrel will be driven into the atmosphere. The moment the piston begins to ascend, the pressure of the air from without closes the valve, V, completely; and, as the piston ascends, a vacuum is left beneath; but when it rises above the opening, B, the air in the receiver rushes into the barrel, and a second depression of the piston will expel the air out of the barrel, and the process may be continued at pleasure. The communication between the barrel and receiver may be closed by a stop-cock; G O is a stop-cock, to let the air into the receiver.

E. LEDGER.

DOUBLE-JETTED BLOWPIPE.

To the Editor of the Mechanic and Chemist.

SIR,—Permit me to offer the annexed plan for a blowpipe, with a secondary or trans-



verse jet. I have not as yet made the experiment, but leave it for those who, having the leisure and inclination, may be induced, from a presumption of its probable effect of increasing the heat of the first projected flame by a counter-current of air, to give it a trial.

I remain yours, &c.,

J. B.

NOVEL EXPERIMENT IN AEROSTATION.

A SERIES of experiments was privately exhibited in the lecture-room of the Polytechnic Institution, in Regent Street, on Tuesday afternoon, by Mr. Green. That celebrated aeronaut has long entertained the opinion, that a balloon voyage from the continent of America to Europe may be safely and certainly effected, founded upon repeated observations on the atmosphere, which have led him to the conviction, that whatever may be the direction of the winds below, the current of air above invariably traverses from some point between the north and west. Mr. Green has kept a regular log of all his numerous voyages. To get into and remain in this current, it is, however, necessary that the balloon should be kept at a certain altitude; and, to show how this

could be effected, was one of the objects of the experiments. The machinery made use of by Mr. Green is both simple and portable, and it is constructed upon a well known pneumatic principle. It is composed of two fans, or blades of wood, attached to a spindle, which passes through the bottom of the car. The fans are of one longitudinal piece, to the centre of which the spindle is fixed, after the manner of a windmill, with but two wings or arms, and their blades present a given angle horizontally, in which direction they move. The effect was as follows :—A miniature balloon, of about three feet in diameter, was filled with common coal gas. To this were attached the hoop, netting, and car, and in the car a small piece of spring mechanism was placed to give motion to the fans. The balloon was then balanced; that is, a sufficient weight was placed in the car to keep it suspended in the air, without the capacity to rise or inclination to sink. Mr. Green then touched a stop in the mechanism, which immediately communicated a rapid rotatory motion to the fans, whereupon the machine rose steadily to the ceiling, from which it continued to rebound until the clockwork had run out. Deprived of this assistance, it immediately fell. The reverse of this experiment was then performed. The balloon was first raised into the air and then balanced. A similar motion was imparted to the fans, the action of which in this case was, however, reversed, and the balloon was immediately pulled down to the ground by their force. A more interesting effect still was then exhibited. The balloon, with the guide-rope attached to it, was balanced as before, the guide-rope having a small brass weight fixed to the end of it. The fans were then removed from under the car and placed sideways upon it, by which their action became vertical. Upon motion being communicated, the balloon floated in a horizontal line, dragging the guide-rope after it, with the weight trailing along the floor, and continued to do so until the mechanism ceased, when it immediately became stationary again. These experiments were frequently repeated with complete success. Mr. Green states, that by these simple means a voyage across the Atlantic may be performed as easily as one from Vauxhall Gardens to Nassau, and he calculated, that from three to four days will be sufficient for the undertaking. *Nous verrons.* The required size of the fans for his monster balloon would be about six feet in length, and the machinery by which they would be turned would be placed inside the car, to be governed at the will of the persons there. These experiments will probably be practically carried out during the summer, by what appears to us to be, under any circumstances, a most perilous undertaking.—*The Times.*

LIFE ASSURANCE.

NO. II.

EXPECTATION OF LIFE.

ASSUMING the word *probability* to mean, in common phraseology, an event almost certain of happening on the one hand, and, on the other, possible of happening, but not so certain; let us remark, for a few moments, the steps which lead to the act of "assuring a life," by assistance of the "Tables of Mortality."

We have observed, that the expected time, or duration of life, is always calculated by way of average. Hence the necessity of finding some fixed method for performing this operation. It will be acknowledged, the thing most desirable to be known, is the terms upon which this business can be transacted. A plan is first determined upon, of the mode in which the benefit or sum to be assured shall be paid, generally at the death of the individual making the assurance with a society; but this will be noticed more at large hereafter. The present age is next ascertained, and satisfactory proof of it given and by the assistance of a previously prepared table, the premium, or annual payment, from the person to the society during his life-time, is readily stipulated. The preparation of this table is the principal difficulty, and can only be done by an experienced calculator; which leads us to value the information more highly conveyed to us in the bills of mortality, when applied to this object.

We may safely infer, therefore, that from a large number of healthy persons taken together, any one may be selected, whose life we can state the expectancy of. Suppose it were ascertained, that out of such a number of persons chosen, 100 could be found aged 25; then, as we have before shown, they would each have the same expected duration of life, by way of average, which would be, according to the Northampton table, very nearly thirty-one years. With each of these, therefore, there would be the same probability of his or her not living more than one year; and the like probability that either might be the person who would live until the age of 96! Yet experience would testify, that they could not all live until 96, nor die at

the age of 26; however good or bad their lives or health might be; but that a gradual diminution would take place until all were dead. Let us, then, farther ask, upon the probability of these deaths happening, as has been stated, what would be required to assure the sum of 500*l.* at death to each of the party? This, it is true, depends, in some measure, upon the interest that the society anticipates making, or, rather, the interest which they allow the assurer throughout the whole period of his life. Now, were sufficient taken from each, to make good the 500*l.* to be paid at death, it would amount to 16*l.* 2*s.* 7*d.* annually, according to the average period they were expected to live. But this is without making any discount or allowance for the interest the society would be enabled to make of the various premiums; therefore, rather more than 12*l.* would be a proper sum for each to pay, as a yearly premium, to assure 500*l.* to each, as their lives might drop.

There would be advantages arising to any well conducted society, who charged this sum for the mere assurance of 500*l.* at death; therefore, it would be but just for the assurer to have a share in the profits thus accumulated, which offices charging this high premium invariably allow; but there remains much to say on this subject at some future time. Having now explained the way in which the term *expectation of life* is applied to the tables of life assurance, we will pass to enumerate the usual rates of premium the offices charge, in our next chapter; and will take also a glance of the various modes adopted by different societies now existing, with a reference to higher authorities upon this interesting subject.

SIGMA.

WRITING INKS AND WRITING FLUIDS.

To the Editor of the Mechanic and Chemist.

SIR,—As the above subject has now for some time taken the attention of the public and the curious, and is giving rise to discussions, which are gradually eliciting facts of the greatest importance to the security of the public, as well as private records; I beg leave to draw your attention to a few particulars in connexion with writing inks, and which, I believe, are as yet but partially known. In the first place, permit me to say, that the object aimed at by the manufacturers of writing inks, has been to obtain a fine black, and one that would resist the action of time and the atmosphere (the most powerful agent). How far they have succeeded I will endeavour to show, by reference first to some experiments made on the subject by Dr. Birkbeck, at the Mechanics' Institution, a short time since. Dr. Birkbeck endeavoured to show, by experiments on many of the blue inks now in such general use, that they (and one in particular) stood the action of the acids so well, as to appearance to give every assurance of their durability; while, by reference to an ingenious article published in the *News* immediately afterwards, it will be seen, on the testimony of some of the most respectable merchants and bankers, that many of their ledgers, written but a very short time with that very fluid, are now almost illegible; and, it is added, "This fact, together with other tests, show, that with respect to durability, blue inks have no advantage whatever (rather less than otherwise) over other inks, and are not entitled to the character bestowed on them by Dr. Birkbeck." The real fact is, the subject being at the time but little understood, Dr. Birkbeck imagined that acids were the most powerful agents he could employ in his endeavours to extract the colour; not so, the blue ink he experimented upon, was composed in body of prussiate of potash suspended mechanically, and that article will resist the action of acid for any length of time, as will most blue bodies to a great extent; while, with common soap and water, the greatest portion of it might have been removed.

From the conflicting nature of the above testimonies, it is very evident most parties were but little informed on the subject. A little attention to the nature of the experiments will solve the difficulty.

An acid applied to a compound fluid must decompose it, unless an acid has already entered largely into the composition of the fluid. When a writing is, therefore, subjected to the action of an acid, and remains almost unchanged, we are warranted to conclude, that an acid must, at one stage of the manufacture, have entered into its composition. But acid, being the most destructive of all substances to an astringent black, as well as to the fabric of paper and cloth; it is not only credible that the same fluid, which stood the test of an acid, faded when exposed to the action of the atmosphere; but it is the very result which its indifference to the acid might have led Dr. Birkbeck and his hearers to expect. The less any of the fluids was effected by the application of an acid, the more likely

it was to contain a principle destructive of its ultimate black colour, and the fabric of the papers.

The value of such exhibitions might safely be left to the test of time and of ledgers, had their plausibility not misled many of those who manufacture writing inks, as well as those who use them.

It will be allowed, that none of the inks hitherto manufactured, have possessed the requisite qualities of blackness, fluidity, and anti-corrosion, arising, in many instances, from the slight knowledge of chemistry possessed by those who have manufactured them. Vegetable matter being at all times the principal portion of writing inks, the object of ink-makers is to destroy that portion which induces decomposition, without the remaining portion being impaired or injured; such being the case, recourse was had to acids, and other powerful drugs, which experience has shown to have entirely defeated their intentions, by destroying the permanent qualities of the ink.

I think the subject may now be said to be set at rest by a recent discovery of Mr. Dugald Murray, whose opportunities (being a practical, as well as an experienced chemist) of investigating and comparing the materials employed in writing inks of different ages, and who has devoted much time to the restitution and general improvement of an important, but long-neglected branch of British manufacture. Referring to a prospectus just issued by Mr. Murray to the London trade, the following occurs, which I take the liberty of extracting at full length :—

" Atramentum (Permaneo).

" Mr. D. Murray, the inventer of the above celebrated writing ink, has been induced to offer it to the notice of the trade and the public, from a conviction in his own mind (after having tried by analyzation the various properties of the inks in use) that an ink was wished for which combined the various qualities of intense blackness at the moment of writing, perfect fluidity, anti-corrosion, and durability, and one that could be applied to every purpose for which writing ink is required, without their having recourse to the multitude of novelties in ink, by which the public are at present annoyed.

Mr. M. feels assured, that one trial will convince any person of the superiority of his " Atramentum (Permaneo)," which signifies an ink that will remain or be permanent—a quality which it possesses in an extraordinary degree; at the same time begs leave to state, that the cause of most inks discolouring, decaying, or becoming illegible after a short time, is the action of the atmosphere upon a portion of the vegetable matter used in making ink, which causes it to decompose while, in the " Atramentum," that portion is entirely destroyed by the admission of ingredients which Mr. Murray has never found to have been employed in any of the numberless inks which he has at various times analyzed."

By reference to that most to be relied on, of all works of reference, the " Encyclopœdia Britannica" will be found the following extract, which fully substantiates the foregoing statement of Mr. Murray :—

" Much as the subject of writing inks has of late engrossed the attention of the *literati* and the curious, we have never found any to possess the requisite qualities of permanence, fluidity, and anti-corrosion, to such a degree as " Murray's Atramentum," to which may be mainly attributed the popularity it has obtained."

The name of " Atramentum (Permaneo," appears to have been adopted by Mr. Murray, not from any desire for eccentricity, but merely to distinguish his ink from the legion of others in existence. The fair Capulet says,

What's in a name?

I answer, much, when a name (as in this instance) can be bestowed on an article which so fully bears it out.

I have to beg pardon for intruding so long on your valuable time; but having experienced great difficulty in obtaining ink at all to my satisfaction, and feeling that others have had the same, I considered the subject of sufficient importance for the length I have extended it to. I have another object in view, besides that of drawing your attention, and that of the public, to a very important discovery, that of endeavouring to show the necessity of inquiry into the media employed, by which the ideas of others, and the knowledge of by-gone generations are conveyed to us—that of writing, without which blessing we should be at once plunged into a state of almost savage barbarism. In the hope that Mr. Murray's invention may meet with the success which it merits, I beg leave to subscribe myself

Yours, most respectfully,
Thomas Martin,
Accountant.

Wilmington Square, London.

LONDON JOURNEYMENS' TRADES' HALL.

A PUBLIC meeting of the working classes of the metropolis was held on Monday, March 9, at the Mechanics' Institution, Mr. Wakley, M. P., in the chair. The theatre, which will contain about 1,500 persons, was completely filled, but the greatest order was preserved, and the different speakers were listened to with unceasing attention. After a characteristic address from the chair, the secretary read to the meeting letters which he had received from Mr. Ewart, M. P., and Mr. Roebuck, the latter of whom had become a shareholder, pledging themselves to support the object of the meeting in every possible way. The report of the provisional committee was then read, of which the following is an abstract:—

"The object of a Trades' Hall is to prevent, as much as possible, the necessity of holding trade meetings at public-houses, and to afford a facility to all the lodges of the large trades in the metropolis to assemble together, on matters of importance, individually to themselves.

To economise the expense of trade societies, by providing them with better accommodation, at a lower rate of rental, than is at present paid by the majority; whether the same be in a fixed sum, or in a supposed adequate consumption of liquor during the hours of meeting.

To concentrate the London trades for the mutual protection and benefit of all; and, generally,

To promote the social and moral improvement of the working class.

A preliminary meeting of the friends of such an undertaking was convened by circular and advertisement, and held in Providence Hall, Finsbury Square, July 11, 1839, at which your provisional committee was appointed, and they immediately proceeded to an active discharge of their duties, by assembling weekly at the Suffolk Coffee-house, 16, Old Bailey. An address was immediately drawn up and forwarded to every trade society, as far as practicable, requesting their co-operation in maturing the proposed measure.

In reply to this address, the provisional committee had the pleasure of meeting with delegates from the following trades, lodges, and societies:—Tin plate Workers' Society, Bookbinders' Friendly Society (Lodge No. 1), City Division of Bootmakers, Camberwell Lodge of the Friendly Society of Carpenters, King's Arms Society of Carpenters, Ladies' Shoemakers, City Branch of the Amicable Society of Operative Plasterers, Manchester Society of Machinists and Engineers (Southwark Branch), Tobacco-pipe Makers, Operative Stonemasons, London Union of Compositors, Lodges 2, 7, 8, 13, and 14, of the Friendly Society of Carpenters, Goldsmiths' and Jewellers' Society for the Prevention of the Increase of the Hours of Labour, Anchorsmiths, Pianoforte Makers, Letter-press Printers, Operative Labourers' Society, Second Society of Carpenters, Hearts of Oak Society of Carpenters, Shoreditch Charter Association, Goldsmiths' and Jewellers' Friendly Society, Working Men's Association, and the North London Charter Association.

On meeting with these delegates, it became necessary to define minutely the design and constitution of the Trades' Hall Company. A prospectus, in a pamphlet form, was, therefore, promptly circulated among the trades' unions, lodges, and societies, as far as the same could be accomplished; yet, in the absence of correct information, it is feared that many of the trades of London have not yet been communicated with. The growing knowledge of such a company leads the provisional committee to hope, that the necessity of supporting it will naturally force itself on the best feelings of these bodies of operatives, and that in time their co-operation will be given and exercised in its behalf.

The design so published, embraced the erection of a large Hall, to accommodate from three to four thousand persons, in the centre of the metropolis, with numerous committee-rooms under the same roof; an extensive library and museum; the delivery of practical lectures; the establishment of schools for the cheap and liberal instruction of the children of operatives, and a refreshment establishment on the premises.

The result of those prospectuses has not been quite so effective as the provisional committee might have anticipated; yet they will not accuse the trades of London with apathy to the welfare of the working men who compose them; there does exist a growing desire to be released from the moral bondage which clings around the present system of trade meetings; and, while a mixture of prejudice and ignorance respecting the humble proposers of this plan must naturally exist among the great majority who toil, the provisional committee venture to believe, that prudential motives alone suggest the apparent lukewarmness of those united bodies of operatives; and they still hope, that after submitting the merits of a Trades' Hall before this tribunal, they shall succeed in

proving the sincerity of their zeal to promote its success among the mechanics of London, in whose hands they desire to commit its sole control and management.

The provisional committee have it in their power to announce, that the Tin-plate Workers' Society, Goldsmiths' and Jewellers' Society for the Prevention of the Increase of the Hours of Labour, and North London Charter Association, have each come forward, in an early stage of the measure, to support it by taking shares, on which they have paid their respective deposits, and their delegates are, at the present time, among the most active members of the committee. Delegates are also in constant attendance with the provisional committee from the Southwark Branch of the Manchester Society of Machinists and Engineers, Lodges 7, 8, 13, and 14 of the Friendly Society of Carpenters, Second Society of Carpenters, King's Arms Society of Carpenters, and Working Men's Association, in each of which they are individually exerting themselves most zealously in obtaining shareholders.

The applications for shares in the Company now forming, amount to nearly 400, all of which proceed from working men, with two or three exceptions; and a great accession of strength is anticipated from the moral effects of this meeting, as numerous individuals have withheld their applications until this meeting shall have been held; and the provisional committee venture to dwell with satisfaction on the favourable results which a development of this noble plan this evening must produce in the minds of those for whose benefit and improvement it is peculiarly designed.

The provisional committee have long been feelingly sensible of the importance of investing the proposed Company with the utmost possible stability, that the respectability of its position, the liberality of its principles, and the extensive prospects of its benefits, might win for it the esteem and unceasing support of the working class. With this view, they early succeeded in securing the assent of Messrs. Prescott, Grote, and Co., to be its bankers, when the occasion for their services should arise. A code of laws for the constitution and government of the Trades' Hall Company have been prepared, and are now duly enrolled. The shareholders are under the shield of the law, which sanctions its progress and success, and a Trades' Hall wants, therefore, but the united energies and subscriptions of the working men of London to erect its walls, its roof, and an open door for their undisturbed use and benefit.

The provisional committee, in conclusion, while they ardently desire such a gratifying consummation of their plan, will hail with pleasure the opportunity of resigning their trust into other hands; the peculiar nature of their appointment by only a small body of friends, renders them doubly anxious to see the growing Company under the management of popularly elected individuals; and they hope soon to be able, in accordance with the laws of enrolment, to convene the first meeting of shareholders for that purpose; it will then be their duty to resign their present functions into the hands of the responsible Council of Forty-five, who will then be elected, and the provisional committee, no longer in existence, will retire from the honourable post which they have enjoyed during the last seven months, more disposed than ever to give their energies and intellects, in their respective spheres, to enhance the success and erection of the working man's best friend in London—A TRADES' HALL!"

The following resolutions were then agreed to; after which, the meeting was adjourned, to be held at the same place on the 11th of May:—

"1. That it is the opinion of this meeting, that the prevailing custom of holding trade meetings at public-houses throughout the metropolis, not only interferes with the good order and business of such meetings, but produces a prejudice against the moral character of the operatives of London, which is made to serve as a pretext for denying them their natural and political elevation in the scale of society.

2. That a central Trades' Hall, on an extensive and liberal plan, erected by, and kept constantly under the controul of the working men of London, is considered by this meeting as eminently calculated to secure to them a free and unmolested right of assembling and discussing at all times, and on all occasions. Embracing the convenience of the principal trades, and the political associations of the metropolis, the better government of their various meetings and societies would immediately follow; while a system of general concentration, and the intellectual improvement of the operatives, would permanently promote their moral and social welfare.

3. That the plan and object of an undertaking now in course of formation, under the title of the "London Journeymens' Trades Hall," having been submitted to this meeting, and fully considered; the same are deemed well adapted to promote the erection of such a building; and the

working men, but more particularly the trade societies of the metropolis, are earnestly advised to support the same in the most effectual manner.

4. That the hearty thanks of this meeting are eminently due to those trades and public-spirited shareholders who have already come forward to its support, and, by their energy and perseverance, effected the enrolment of the Company now forming, and the publication of an ample and liberal code of laws for its constitution and government."

We cannot flatter ourselves that all our readers will concur with our opinion on this subject, but we will nevertheless express it conscientiously, and without reserve—That the operative class, including all the numerous trades in this city and its neighbourhood, should combine as a community, for the purpose of promoting their mutual welfare, and that, in order to effect that object, they should possess a hall proper for the transaction of public business is much to be desired; because we are convinced, not merely by speculative reasoning, but by absolute experience and observation in other countries, that such combination, if properly conducted, would promote good fellowship among men, and afford assistance in distress, and good council in difficulties, which can only be partially and imperfectly obtained from less numerous, influential, and enlightened assemblies. A society was formed some years ago in Geneva, called the "*Reunion des Industriels*," or meeting of the working classes; the first condition proposed, and to which they have ever since strictly adhered, was, that they should be perfectly independent of all persons of superior rank and fortune; and although they have the advantage of counting among their members, men whose scientific reputation extends over the whole civilized world; and although they have received gifts to a considerable amount, from those who have been deservedly favoured by fortune, still no individual possesses the power of controlling the affairs of the society, or has any claim upon the common property, beyond that which belongs to the humblest individual in the society. Notwithstanding the exclusiveness of these regulations, an excellent understanding exists between the government and the institution; and the latter has, upon various occasions, been consulted by the legislature, and the wishes of the society have been acceded to, and formed the bases of laws which especially concern the classes which the society represents.

This is the position which the working men of this country ought to occupy; but it can never be attained by an alliance with intriguing politicians, especially with a faction that seeks the dismemberment of the empire abroad, and the dissolution of its institutions at home. We do not wish to see the working classes "dreaded" by the rest of society, as recommended by Mr. Wakley, but we wish to see them respected, and in a position which must command respect. We do not wish to see the Trades' Hall usurp the power of the legislature, as advised by Dr. Bowring, because we conceive the professions of a respectable tradesman and a revolutionist to be incompatible. But even those who consider it convenient and proper to join political factions, must perceive the impolicy of allowing any party, foreign to the working class, the power of controlling the affairs of the institution; for should the shares rise in the market, they not only *might*, but most probably *would*, be sold to the best bidders, as is customary in *jobs* of this kind. Thus the members of the Institution, from being the tools of a clique of demagogues, might be made the slaves of an exactly opposite party. These and many other considerations induce us earnestly to recommend the working men of this city, *not to join the society upon the proffered terms*, but to meet together and discuss their own business without the assistance of any professional spouters whatever. If they cannot raise fifteen thousand pounds, let them be contented with fifteen hundred. Surely, if the undertaking were properly understood and appreciated, 1,500 men might be found willing to subscribe sixpence per week for a period of forty weeks; and then they would not only be independent of all external influence, but have an opportunity of discovering who are their *real* friends, as they would probably receive considerable donations in fartherance of their object, and that, perhaps from quarters where they least expected it. In conclusion, we strongly recommend the project of erecting a Trades' Hall; but consider it essential to its beneficial operation, that it should be the common property of the members; and, above all, that the acts and resolutions of the society should be such as would conciliate, rather than alarm the higher classes.

MR. JOHN BROWNE, THE LATE EMINENT ARTIST.

Full many a gem of purest ray serene,
The dark unfathom'd caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness in the desert air.'
GRAY.

IT is with sincere regret that we have to announce the decease of Mr. John Browne, a highly-talented artist, who expired, after a lingering illness, at his residence, Clarendon Square, Somers Town, on Saturday last, at the early age of 35, leaving a sister and niece, who were wholly dependant upon him, entirely destitute of the means of support. Mr. Browne ranked among the most rising artists of the day, and produced some delightful specimens of beautiful drawing. In proof of this assertion, we may instance "Finden's Tableaux;" "The Diadem," published by Smith and Elder; "The Book of Royalty," by Ackerman; Mrs. Howitt's "Birds and Flowers;" and various other productions of first-rate merit. It is a melancholy reflection to think of genius or talent, of a high order, fading and vanishing before us in its very prime. Mr. Browne was unquestionably, not to speak in terms of exaggeration, a man endowed with a fine sense of whatever is lovely or beautiful in nature; or otherwise he could not have imparted those exquisite touches, those delicate refinements, by which his works are distinguished, which minds alone of the nicest sensibility could conceive, and which could be accomplished only by the most fervid zeal. No man was more warmly esteemed or beloved, by those who enjoyed the pleasure of his intimacy, than this lamented gentleman. He was a generous friend, and an excellent man; of a benevolent disposition; and it may be truly said of him, in the words of Pope's epitaph upon Gay, that he was

In wit a man, simplicity a child.

It is hoped that the patrons of the fine arts, with their wonted liberality, will come forward and do something to mitigate the sorrow and distress in which the sister and niece are plunged by this afflicting event.—*Advertiser.*

[We recommend the above truly lamentable case to the especial notice of our readers. From our having been personally acquainted with the late Mr. Browne, we can conscientiously affirm, that the "*Advertiser*" has not said a word too much in his praise. We are happy to add, that a subscription is about to be raised on behalf of his bereaved relations.]

REVIEW.

The Traveller's Guide through England and Wales, and the Principal Part of Scotland; with the Railways, Canals, and Roads, laid down with great precision. Corrected to the present Year, according to the best Authorities.

A Geological View of the Mountains, Hills, and Remarkable Eminences of England and Wales. Compiled from the Papers of the Geological Society, and private sources. By the Rev. T. WILSON. London: Darton and Clark.

No man should be without a map of his own country, especially at the present period, when it has undergone such considerable improvements by the introduction of railways through the various routes. The maps before us appear, as far as we have been able to examine them, to be executed with great care, and present at once useful and tasteful ornaments for the parlour or the study. We cordially recommend them.

THE CHEMIST.

CHEMICAL ANALYSIS.

To the Editor of the Mechanic and Chemist.

SIR,—If the following papers, which I propose to send on "Analysis," you should deem worthy of insertion in your valuable little journal (which I have not but till lately had the pleasure of perusing), you will confer a favour, perhaps, as well as to many young chemists who read your valuable periodical, as unto him who begs to subscribe himself

Your obedient servant,
MANIPULATOR.

ANALYSIS.

In treating, in a brief manner, on this important part of chemistry, I shall explain it in the following order:—1st. Analysis of gaseous mixtures; 2nd. Analysis, or separation of different metals, when combined in one ore or specimen; 3rd. The tests, &c., for the respective earths and metals. Having not much pecuniary means, I am obliged to make most part of my apparatus myself, which I shall describe to you; as, perhaps, some person in like circumstances may be benefitted by it.

1st. *Analysis of Gaseous Mixtures containing Oxygen.*—This is performed by an instrument called Volta's endrometer, being the invention of Professor Volta.

Fig. 1 consists of a glass tube, closed at one end, and rather widened at the other, of about three-fourths of an inch in the bore. It is graduated and divided into 100 parts; through the closed end is inserted a piece of wire, having a small ball at each end.

In performing the analysis, a portion of air is measured in a graduated tube, which is generally done by means of the pneumatic trough; it is then mixed with a portion of hydrogen, which should be rather more than sufficient to unite with all the oxygen present. This mixture is then introduced into the endrometer; it is placed in a trough of either mercury or water the thumb is applied to the widened end of the tube; an electric spark is passed through, which causes immediate detonation. You then divide the total diminution in volume by 3, which indicates the quantity of oxygen originally contained in the mixture. Not having an electrical machine, I usually employ an electrophorus, which generally answers my purpose very well.

Fig. 2 consists of a tin dish (circular),

Fig. 1.

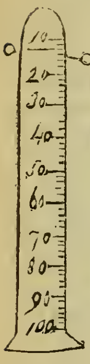
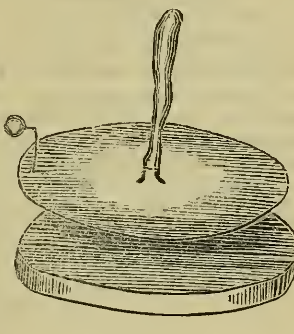


Fig. 2.



filled with a composition of shell-lac and rosin; and another tin plate, made exactly to fit, with a socket on the top, to contain a glass handle. When wanted for use, it must be well warmed, and then quickly brushed over with a piece of flannel; the top plate is then put down. You touch it with your finger, lift it again, and apply the small knob on the upper plate to the wire of the endrometer.

Instead of electricity, spongy platinum is sometimes used; in this case, the hydrogen used should be kept for a few hours over mercury, in contact with a platinum ball, to free it from traces of oxygen, and a piece of caustic potassa to deprive it of moisture. The platinum balls may be made by mixing three parts of platinum to one of pipe-clay, made into a paste with water, and then rolled into a small ball; a little chloride of ammonia should be mixed with the paste, and when the ball is dry, ignited at the flame of a lamp. When the ammonia escapes, the ball also should be heated well before being used. It must be performed in a mercurial trough. If performed in a tube of the size I have given, the diminution arrives at its full extent in about eight minutes.

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 244).

TIN.—58.

Tin is a very ancient metal; it was known to Moses, and mentioned in the Book of Numbers. It was used by the Phœnicians, who obtained their ore from the mines of Spain and Britain. It was also known to the Egyptians, Greeks, and Romans. It is a very white and brilliant metal; hence it was called Jupiter by the ancients, from its brilliancy, being supposed to resemble that of the planet.

It is not oxidized by exposure to air. It is quite malleable, and is rolled out into thin leaves, called tin-foil, which is extensively used in the arts. It is used by dentists in plugging decayed teeth.

Tin may be distinguished from all other metals, by giving a peculiar crackling sound when bent. It melts at the temperature of 442°, and, when heated to whiteness in the open air, takes fire and burns with a splendid white flame, producing an oxide of this metal.

Tin is most extensively used in the arts, in combination with other metals. United with lead, it forms solder, used by the tin-plate workers in soldering their vessels. Common tin ware is made of plates of sheet-iron covered with a thin coating of metallic tin, prepared by dipping the sheets of iron, previously cleansed, into melted tin. Vessels made of this material, are sometimes called block-tin ware. Copper tea-kettles, and other vessels of the same metal used for domestic purposes, are covered on the inner surface with a coating of tin, prepared by first cleansing the surface of the copper, and then melting the tin in the vessel, a thin coating of which will adhere to the copper, and the rest, in a melted state, is poured off.

Exp.—Take a piece of sheet copper, and place on it a small bit of tin and a little powdered rosin, and hold it over a spirit

lamp, the flame of which melts the tin, and causes it to unite with the copper, and its surface becomes covered with metallic tin.

Block-tin vessels, such as tea-pots, coffee-urns, &c., are tin, containing about five or six per cent. of brass, and a small quantity of metallic antimony. The articles are cast in copper moulds, generally in pieces, and afterwards soldered together and polished.

Britannia ware is made of the same materials as the block-tin ware, except that, for the brass used in the block-tin, copper is here substituted. The articles are formed by first casting the metals into thin sheets, and then beating them up into the desired forms by hammers and other instruments.

There are two oxides of tin, the protoxide, and the peroxide. The latter is a pale yellowish powder, and is used in the arts, under the name of putty of tin, for polishing metals, and, when melted with red lead, it forms white enamel, of which watch and clock dials are made.

There are two combinations of tin and sulphur, called protosulphuret and bisulphuret; the latter has been known from the earliest ages, and has been used in the arts, under the name of Mosaic gold, to give a golden colour to bronzed and japanned work. The bronzed iron railings are frequently prepared by mixing this article with the paint when it is laid on. Sometimes they are painted, and then various bronzes are laid on afterwards.

LEAD.—104.

Lead is rarely, if ever, met with in the native state; but in combination, and especially with sulphur, it is an abundant natural product, called, by mineralogists, galena; but more commonly lead ore, as it is the only ore from which the metal is obtained.

The process for reducing the ore is exceedingly simple. The ore and common wood fuel are packed in alternate layers, in a furnace, and the wood set on fire, and by the combustion of it the sulphur is expelled, and the lead, in a melted state, runs into the bottom of the furnace, whence it is drawn off into moulds, where it cools, forming bars, which are called pigs of lead.

Lead has a bluish colour, and strong metallic lustre; but soon tarnishes by exposure to air. Its specific gravity is 11.38. It is malleable and ductile, and is so soft, that it may be scratched with the finger nail. Its malleability fits it for many purposes in the arts, in the form of sheet-lead. It melts at 612°, and boils at a red heat.

Lead is extensively used in the arts; with antimony, it forms the alloy of which types are made; with tin, it forms pewter; with a small quantity of metallic arsenic, it is used to make shot. The sheet-lead that lines the tea-chests, is made by pouring the melted metal on cold plates of iron or stone, in an inclined position, by which process a thin coating of metal is formed on the flat surface, and the remainder runs off, and is collected for another operation.

Lead is rapidly oxidized by exposure to heat and air; a yellow crust first appears on its surface, which, in common language, is called dross, but by the workmen and in commerce, massicot; it is the protoxide of lead, and, when pure, is of a lemon yellow colour; it combines with acids, forming salts. The sugar of lead consists of this oxide, combined with acetic acid.

Litharge is also an oxide of lead, prepared by heating massicot exposed to the air, from which it takes up an additional portion of oxygen. It consists of a mixture of the protoxide and deutoxide.

Common red lead is the deutoxide of lead, and is sometimes called minium. This compound, like the preceding ones, is prepared by heating the metal, or litharge, in contact with air; but requires a longer time for its formation. It consists of one atom of lead and one-and-a-half of oxygen, or it may be considered as composed of two atoms of lead and three of oxygen.

COPPER.—32.

Copper has been known from the earliest ages. An alloy of this metal with tin, formed the cutting instruments of the ancients. Their arms, and many of their domestic utensils, were made of this alloy. Copper, it is supposed, was discovered in the island of Cyprus; hence the word *cuprum*, which is the Latin name for copper. This metal is frequently found native, and it is, doubtless, owing to this circumstance, that it was so early known and employed in the arts.

Obs. A mass of native copper was found in the vicinity of Lake Superior, weighing 2,200 pounds. It is frequently found in masses of several pounds' weight.

Copper is readily distinguished from all other metals, except titanium, by its red colour. It receives a high metallic lustre by polishing. Its specific gravity, when fused, is 8.66, and may be increased by hammering. It is both malleable and ductile. It melts at a white heat, and, if freely exposed to air or oxygen, it burns

with a brilliant green flame. In dry air, copper undergoes little change, but moist air soon oxidizes it, forming a green crust upon its surface.

Copper is extensively used in the arts, both in a state of purity and in combination with other metals.

Obs. 1.—Pure copper is extended between iron rollers into thin sheets, which are used for covering the bottoms of vessels, and for making utensils of almost every description.

2. From its ductility it is drawn into wire, which is considerably used in the arts, and the strength of which is only inferior to that of iron.

3. *Brass* is an alloy composed of about three parts of copper and one of zinc, and is formed by melting the two metals together in a crucible.

4. *Bell-metal,* of which church bells are made, consists of an alloy composed of about four parts of copper and one of tin.

5. Common pins are made of brass wire, covered with a thin coating of metallic tin.

Oxides of Copper.—There are two definite compounds of copper and oxygen:—The first, or protoxide, is a native product, and is called by mineralogists ruby copper.

When copper is heated to redness in open vessels, it becomes covered with scales, varying in colour from a dark brown to a bluish black; this is the black oxide, and contains twice as much oxygen as the preceding compound. Calling the first the protoxide, this should be denominated the deutoxide.

There are two native compounds of copper and sulphur, the protosulphuret and bisulphuret; both have a yellow colour, and constitute the chief ores from which the metal is obtained. The first is called by mineralogists copper glance, and the second copper pyrites.

Dr. Turnbull.—About three weeks ago, a respectable mechanic, employed in her Majesty's Dockyard here, and his wife, having three children born deaf and dumb, applied to us for a letter of introduction to Dr. Turnbull, which we complied with, being anxious to test, to the utmost of our power, the effect of his wonderful discovery upon them. The mother and her three children accordingly waited upon the Doctor, at his residence in Russel Square, and were received with great kindness. After being a fortnight under his care, we are happy to say that they have returned home, and can now hear perfectly well. The eldest girl had been in eight hospitals, and under every species of treatment for her unfortunate malady, but without the slightest benefit. She can now, however, hear the ticking of a watch distinctly at a distance of ten feet. The other two children, being young, cannot comprehend the meaning of sound; but it is evident they have acquired the blessed faculty of hearing, and will ultimately reap the benefit of it, by being able to speak at no distant period. We are glad that we put Dr Turnbull's discovery to a severe test in this instance, as the parties being strangers both to us and to him, prevents the possibility of collusion, and fully establishes his claim as a benefactor of the human race. We visited several of his patients on Wednesday, and were truly astonished at the wonderful cure performed upon a boy about eight years of age, named Charles Davies, who, in an incredibly short space of time, can speak perfectly, having acquired the faculty of hearing in a most extraordinary manner, requiring to be seen by those who knew him previous to his being placed under the Doctor's care, before they could believe it possible to effect such a change.—*Woolwich Advertiser.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, March 25, G. H. Bachhoffner, Esq., on Chemistry. Friday, March 27, G. Bennett, Esq., on Oratory and the Drama. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, March 26, A. Morton, Esq., on Mechanics. At eight o'clock.

Poplar Institution, East India Road.—Tuesday March 24, C. Clarkson, Esq., on Practical Education. At eight o'clock.

Eastern Literary and Scientific Institution, No. 88, Hackney Road.—Tuesday, March 24, —— Kite, on Elocution. At eight o'clock.

Franklin Mutual Instruction Society, Lower Whitecross Street.—Monday, March 23, the Rev. William Vidler, on the Natural History of Mammalia:—Sloths and Ant-eaters. At half-past eight precisely.

QUERIES.

How to make brown Windsor soap?

AN INQUIRER.

A good receipt for making Bengal lights? I have the following, but it does not burn well:—Saltpetre, $2\frac{1}{2}$ oz.; sulphur, $\frac{1}{2}$ oz.; finely-powdered zinc, $\frac{1}{2}$ oz., and the proper cases for them. Also the receipts for making coloured fires that will burn in cases? W. H. W.

1. How to make a dye for faded black silk? 2. How to preserve ginger? 3. How to make blue ink? R. S. M.

1. How to clean or repolish gilt frames? 2. The cheapest and best method to procure gold ink for printing, and how laid on the type?

A TYPOGRAPHER.

1 How are the various patterns given to snuff-boxes? 2. How are the best sort of snuff-boxes

polished or varnished, and what polish or varnish is used, with the manner in which the same is applied? 3. What is the scent used for perfuming Windsor soap? 4. What are the names, and quantities used of essential oils, &c., to produce a very delicious perfume? H. J.

In making experiments the other day with a galvanic trough, I found the following results to take place, which, if any of your correspondents will explain, you will greatly oblige J. J.

I filled two glasses with pure water, and connected the positive and negative ends of the trough, and the water in the glasses, with moistened thread, and immediately oxygen gas was disengaged at the extremity of the one, and hydrogen at the end of the other thread in the glass. Now what becomes of the hydrogen in the vessel where the positive wire is placed? Why does not oxygen appear in the other vessel in which the negative wire is placed?

Being in want of some mechanical drawings, well executed in Indian ink, &c., by hand (not prints), any of your correspondents possessing the same, and wishing to dispose of them, may meet with a purchaser, by addressing a letter, during the ensuing week (stating their description, &c., and where they may be viewed) as under.

For H. W., care of Mr. M'Millan, stationer, &c., Highbury, Islington.

The process gold bronze goes through after the metal is beat and ground, that gives it that bright and silky appearance, and makes it work so soft? W. W.

The proportions of copper and silver used in making what is called jewellers' gold, and how to melt the same? How to make gold size? H. B. B.

1. Where can I purchase the small pipes, such as are used in bird organs, ready made? 2. What is the construction of the pedometer? 3. What is the construction of the pocket barometer? (*Query, thermometer).* I have seen them at a barometer maker's in Museum Street. 4. Can you give a description of church organs as to construction? Where can I purchase a good second-hand compound microscope? SMUGGINS.

ANSWERS TO QUERIES.

"An Amateur Chemist." 1. Does the vinous fermentation always precede the acetous fermentation, or can the latter take place without the former? It was long supposed on the authority of Boerhaave, that the acetous is universally preceded by the vinous fermentation; but this is an error; for starch in the vats of the starch-maker and dough, form vinegar, without any previous production of wine; so, again, in certain solutions of saccharine matter, the acid is evidently generated without any alcoholic state of the fluid.

2. Is the cream of lime used by coal-gas manufacturers for the purpose of abstracting carbonic acid from the carburetted hydrogen, or to abstract carbon? Certainly not to abstract the carbon, excepting in the form of carbonic acid, with which it combines. It also absorbs the sulphuretted hydrogen.

3. *To Regulate the Flow of Gas through an Argand Burner.*—A stop-cock. I should say, the gas to be turned on until the light is at its maximum, which, of course, will be the quantity of gas required. J. MITCHELL.

To take out Stains of Ink, Oil, and Grease from Books.—Oxymuriatic acid removes perfectly stains of ink; and should the paper require bleaching, the operation will answer both ends at the same time. Nearly all the acids remove spots of ink from paper; but it is important to use such as attack its texture. Spirits of salt, diluted in five or six times the quantity of water, may be applied with success upon the spot, and after a minute or two, washing it off with clean water. A solution of oxalic acid, citric acid, and tartaric acid, is attended with the least risk, and may be applied upon the paper and plates without fear of damage. These acids, taking out writing ink, and not touching the printing, can be used for restoring books where the margins have been written upon, without attacking the text.

Method of Reducing Deals to the Standard Hundred (that is, 120 of 12 ft. $1\frac{1}{2} \times 11$).—Set down the number of deals in 1st column, length in 2nd, breadth in 3rd, and thickness in 4th; multiply all these numbers together, and put down the product in column 5. Add up the various sums in column 5, and divide by 198, the quotient will be the answer.

N. D.	L.	B.	T.	
10 ×	12 ft. ×	11 in. ×	2 =	2640
5 ×	10 ×	9 ×	$2\frac{1}{2}$ =	1125
7 ×	14 ×	9 ×	3 =	2646
8 ×	16 ×	11 ×	3 =	4224
				10635

198)10635(53
990

735
594

$\frac{141}{198} = \frac{8}{11}$ nearly.

H. Q. F.

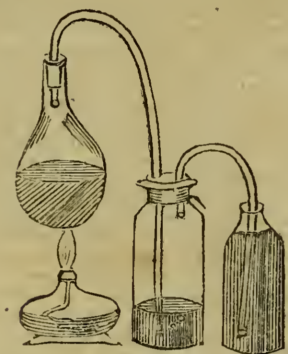
Answer $53\frac{8}{11}$; that is, 0. 1. $23\frac{8}{11}$

I am a timber merchant, and that is the method I make use of; and the fractions of deals are always considered as so many elevenths. The first part of the query is not quite explicit enough, as you have not stated whether they are sold at per foot run or per foot square of two inches. They are never sold so in London. W. SMALL.

To Restore Paper that is disfigured with Stains of Iron.—This may be done by applying a solution of sulphuret of potash, and afterwards one of oxalic acid. The sulphuret attracts from the iron part of its oxygen, and renders it soluble in the diluted acids.

Chlorate of Potash.—Chlorine is made by pouring hydrochloric acid on half its weight of black oxide of manganese in a flask, then applying a gentle heat; the gas should be passed through a small quantity of water, in order to absorb any hydrochloric acid that may pass over; it should then pass into a solution of potassa, until the liquid is found by reddened litmus-pa-

per to be neutral. This liquid contains chlorate of potash and chloride of potassium, the former of which is much less soluble in cold water, and therefore crystallizes, while the chloride remains in solution.



I doubt, however, whether this salt can be prepared at much less cost than its price; as when manufactured on the large scale, the residues of this operation can be applied to other purposes. J. J. F.

To Erase Spots of Grease, Wax, Oil, &c.—Wash the part with ether, and place it between white blotting-paper; then with a hot iron press above the parts stained, and the defect will be as speedily removed. In many cases, where the stains are not bad, rectified spirits of wine will be found to answer the purpose.

P. Amer.

To make Red Ink for Marking Linen.—Vermilion, half an ounce; salts of steel, one drachm; let them be finely levigated with linseed oil to the consistency required for the use of types, hair pencils, or pens. H. B. B.

TO CORRESPONDENTS.

O W.—*Several methods of making ginger beer have been published in "The Mechanic." In No.* 113, *there are two valuable receipts*, viz., Instantaneous Ginger-Beer. *Fill a bottle with pure cold water, then have a cock ready to fit it; also a string or wire to tie it down with, and a mallet to drive the cork, so that no time may be lost; now put into the bottle sugar or syrup, to your taste, and a teaspoonful of good powdered ginger; shake it well, then add the sixth part of an ounce of supercarbonate of soda; cork rapidly, and tie down—shake the bottle well—cut the string—the cork will fly—then drink* ginger beer.

Ginger-Beer Powders.—*Ginger powder*, 1 *drachm; carbonate of soda*, 7 *drachms; powdered white sugar*, 3 *ounces; essence of lemon*, 25 *drops. This quantity to be well mixed, and divided into twelve powders, or papers; each paper to be accompanied with* 25 *grains of tartaric acid in a separate paper.*

R. E. W. *wishes to know how to solder brass to tin, brass to brass, tin to tin, and iron to either of the former. The tin solder used by tin workers, will answer for all the above purposes; but, when iron or steel is to be soldered to brass or tin, sal ammoniac must be used instead of resin. If greater strength is required in soldering iron to brass, or brass to brass, silver solder or spelter may be employed, with borax for the flux. The back Numbers of "The Mechanic" may be procured at the publisher's.*

Adolescentulus.—*Specific gravity is the weight of a body of given bulk; thus the weight of a leaden bullet is greater than that of a marble of the same size; it is, therefore, said to be* specifically—*that is to say, in* specie, *or kind, heavier than the marble.*

J. B——n.—*The barometer is not subject to so great fluctuations in the high northern and southern latitudes, as are observed in the tropical regions, for reasons already explained. It seldom or never descends below* 28 *inches in high latitudes. The atmospheric pressure is not affected by local temperature; but a higher column of mercury will be sustained at a high, than at a low temperature, because the heated metal is specifically lighter than when cold. The cause of the falling of the mercury, at an increased temperature, was probably, as before intimated, owing to the presence of a small quantity of air above the mercury. It is true, as our correspondent remarks, that the same absolute weight is sustained, under all circumstances, of expansion and contraction, if the whole quantity remain in the tube; but the capacity of the tube being increased, that weight is incumbent on a larger surface of the reservoir, and the column of mercury is lower than it would be if the glass did not expand: the equilibrium is, therefore, restored by the mercury being forced up the tube from the reservoir, by the superior pressure of the atmosphere, and when the temperature is lowered, the contrary takes place, and a portion of the mercury is discharged into the reservoir. In all cases, the height of the column sustained by a given pressure of the atmosphere, varies directly as the expansion; or, which is equivalent, inversely as the specific gravity of the metal. This explanation will correct an error which our correspondent has pointed out in our last Number.*

Melek Ric.—*We shall be glad to see the papers he offers; if of a practical nature, they may be useful to many of our readers. His queries shall be attended to.*

G. S.—*The address is*, 33, *Navigation Street, Birmingham.*

Hodge's *Garden pots are of no utility whatever.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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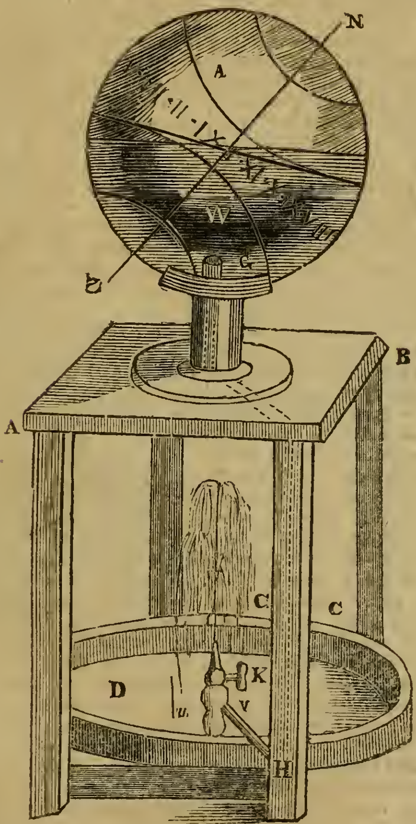
SELF-SUPPLYING FOUNTAIN AND SUN-DIAL.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

SELF-SUPPLYING FOUNTAIN AND SUN-DIAL.

(See Engraving, front page.)

This ingenious invention is recorded in the "Exper. Phil." of Desaguliers, and is thus described :—G N S is a hollow globe of thin copper, eighteen inches in diameter, supported by a small inverted bason, resting on a frame, A B C, with four legs, between which there is a large bason of two foot diameter. In the leg, C, there is a concealed pipe, proceeding from G, the bottom of the inside of the globe, along H V, and joining an upright pipe, *u* I, for making a jet at I. The short pipe, I *u*, going to the bottom of the bason, has a valve at *u*, under the horizontal part, H V, and another valve at V above it, and under the cock. At the north pole, N, there is a screw for opening a hole, through which the globe is supplied with water. When the globe is half filled, let the machine be set in a garden, and, as the sun heats the copper and rarifies the included air, the air will press upon the water, which, descending through the pipe, G C H V, will lift up the valve, V, and shut the valve, *u*, and, the cock being open, spout out at I, and continue to do so for a long time, if the sun shines, and the ajutage be small. At night, as the air condenses again by the cold, the outward air, pressing into ajutage, I, will shut the valve, V; but, by its pressure on the bason, D *u* H, push up the water which has been played in the daytime through the valve, *u*, and the pipe, *u* H G, into the globe, so as to fill it up again to the same height which it had at first, and the next sunshine will cause the fountain to play again, and so on continually till the water be exhausted by evaporation, and then it will be necessary to pour a fresh supply into the bason. The use of the cock, K, is to keep the fountain from playing till you think proper. A small jet will play six or eight hours. If the globe be set for the latitude of the place, and rectified before it be fixed, with the hour-lines or meridians drawn upon it, the hours marked, and the countries painted upon it, as in the common globe, it will be a good dial; the sun shining upon the same places on this globe, as it does upon the earth itself. The proper position of the globe, in a northern latitude, is the twelve o'clock pointing due south, and the axis parallel with the axis of the earth.

This construction of dial, though accurate in principle, will be found inconvenient in practice, owing to the indistinctness of the line which separates the light part from the shade; the improvement I would suggest is, to substitute a transparent glass globe for the copper one, with an axis passing through the centre, whose shadow on the part opposite to the sun will indicate the correct solar time. The obstacle to this construction is, that the zone on which the hours are painted (on a semi-transparent surface, by grinding or otherwise), can only extend to half the circumference, or from six in the morning to six in the evening; otherwise a portion of the semi-transparent zone would obstruct the passage of the rays at periods near the equinoxes. This inconvenience would not, however, be experienced, when the sun is considerably to the north of the equator, the time of the longest days. If the globe be filled with any limpid fluid, and the fountain omitted, a bright disk of light with a reduced, but distinct shadow of the axis passing across its centre, will be visible on the zone, at all seasons, when the sun is shining. A tube must be attached to the lower part of the globe, communicating with a reservoir of the fluid, in order to allow for the excess of expansion in the fluid, above that of the glass; if this be neglected, the globe would burst at an increased temperature, or air bubbles would enter at a lower temperature.

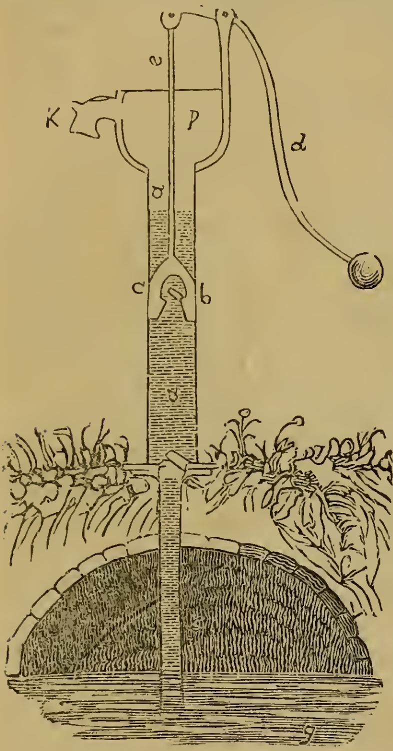
In a future paper, I will show how a *moon-dial* may be constructed, to show the time at night, notwithstanding the faintness of the light, and the complication of the motions of that planet.

Q. E. D.

HISTORY AND APPLICATION OF THE PUMP.

It is generally believed, that before the great Archimedes' time, the only apparatus used for raising or drawing water from wells, &c., was simply a bucket with a rope attached, which was either drawn up by the hands or attached to a windlass, similar to those now used in country places; for we have no account of any more complicated machinery being used for that purpose, until the introduction of the Archimedian screw (about 200 years before Christ), by that celebrated philosopher, whose name it bears. It was used at that time for draining the land in Egypt, which was occasionally so inundated by the Nile, as to be unfit for agricultural purposes; but even that was deficient in many instances; for it being so exceedingly cumbrous, if used to any extent, and so liable to become choked by dirt and weeds, it could not be used for raising water to any great height. This circum-

stance led to the introduction of the pump, which, according to Vitruvius, was invented about 135 years before Christ by Ctesebes, a celebrated mathematician of Alexandria; but little respecting its particular construction is handed down to us. It is, however, generally supposed to have been on what is now technically termed the lift-and-force principle, which will be hereafter described. This form of application does not seem to have been so commonly used even in earlier times, as the more simple construction, called the lift or suction-pump, of which the following is a description :—*a a* is a hollow cylinder,



called the barrel, having an air-tight piston, *b*, with a valve, *c*, opening upwards, working within it by means of the lever and rod, *d e*; *f* is the feeding-pipe, descending into the well or cistern, *g*, through which the water passes for the supply of the pump. It will be readily seen, that, upon the elevation of the lever, the piston, *b*, is depressed, by which action it forces out a portion of the air contained in the barrel through the valve, *c*; the water being driven up the feed-pipe by the force of the external atmospheric pressure, in proportion to the air discharged, until it reaches the body of the pump, when, upon the descent of the piston, it forces its way through the valve, *c*, which having once passed, it cannot return, in consequence of its opening upwards, and being both air and water-tight; it is, therefore, carried up to the cistern, *p*, where it is discharged at the spout, *k*.

Before entering into any farther description of the various pumps now in use, it may be as well to introduce a few remarks upon that subject which so long remained a mystery to the philosophers of old, and which has so material a part to perform in the action of the pump, viz., atmospheric pressure. It must be understood, that, when Ctesebes invented the pump, he was totally ignorant of the laws which regulate its action. Many of the philosophers of those days attributed the cause of the water rising in the pump, to the extraordinary power of suction which the piston possessed; hence arose the name of "suction-pump," while the philosophers of a later date attributed it to the abhorrence of nature for a vacuum; and thus the matter rested until near the commencement of the seventeenth century, when it so happened that a pump had been erected at Florence, and the distance through which the water had to be raised in that pump exceeded the maximum height, viz, 32 feet; the persons engaged in the undertaking were, consequently, surprised to find, that the water did not reach the top as usual. This circumstance attracted the attention of the illustrious Galileo, who resided in that city. The philosopher, finding that the water would not rise to its top as usual, set himself immediately to endeavour to account for the unexpected phenomenon, and, after carefully examining the case, came only to the conclusion, that nature certainly abhorred a vacuum, *but only for the first two-and-thirty feet.* It was his pupil Torricelli who first demonstrated the true cause of the phenomenon; he remarked the water rising, as it does, only to a certain height, must, in fact, be not drawn, but pushed into the barrel of the pump, and it can only be so pushed by the pressure of the atmosphere on the exposed portion of it. The thirty-two feet of water in the body of the pump are merely a counterbalance to a column of air of equal basis reaching to the top of the atmosphere. It will be seen from the above facts, that the lift-pump of ordinary construction can only be

used where the distance through which the water has to be raised, does not exceed thirty-two feet. The lift-and-force pump, therefore, possesses many advantages over this, which I will make the subject of another paper.

EPICTETUS.

LONDON JOURNEYMEN'S TRADES' HALL.

To the Editor of the Mechanic and Chemist.

SIR,—I am directed by the Committee to acknowledge your kindness in giving publicity to the proceedings of the public meeting, called in favour of the above undertaking on the 9th of March; and while they dissent from the remarks you have appended to the same, they respectfully beg your acceptance of their thanks for the candid manner in which you have expressed your opinions on the subject, which they, however, hope will be changed by a perusal of the laws which I have the pleasure of sending you.

I am, Sir,
Your obedient servant,
WM. FARREN, Jun.,
Secretary, *pro. tem.*

London Trades' Hall Office, Suffolk Coffee House, 16, Old Bailey, March 25, 1840.

To the Editor of the Mechanic and Chemist.

LONDON TRADES' HALL.

Sir,—Your candid remarks at the close of a notice of some proceedings at a public meeting in favour of this undertaking on the 9th instant, are evidently written in ignorance of the real *constitution* on which it is based, and I am, therefore, anxious to disabuse your mind, if possible, of sundry prejudices which you seem at present to possess, to its general discredit. I address you, not as the official organ of the Company now forming, but merely as an individual, deeply interested in its success, who has worked hard in its behalf from the first moment of its existence, and borne the most conspicuous part in its projection.

You place, by comparison, the London Trades' Hall *indirectly* in juxtaposition with the Geneva Society, in which "no individual" has "the power of controlling the affairs." I can assure you, that, in drawing up the laws which govern the shareholders, I have been deeply anxious to vest the *sole* management of the project in the hands of the *working men*, and I do venture to think, that I have effectually secured that great point, and barricaded the *transfer of shares* so closely, that no speculator can enter among the shareholders; nor can the shares ever get into the market to become *jobs*. Allow me to call your notice particularly in this place to the 2nd, 24th, 25th, 28th, 44th, 45th, and 60th laws. The working men must ever control the Trades' Hall, so long as two-thirds of them hold shares, and are qualified to vote, and act on the Council; and the fact of a great majority being operatives among the shareholders, must secure, from time to time, a council of working men, because the rich man, however greatly desirous to benefit the institution by his 100 or 1000 shares, can do no more harm with his *one vote*, than the unwashed labourer, who claims his solitary share. Equality reigns among the shareholders of this undertaking, and the laws will convince you, I trust, that no mercenary man can make *a property* in the project. The ordeal of passing the approbation of thirty working men before registration, must, I presume, have a tendency to destroy *jobbing* in the shares, and keep, therefore, the Trades' Hall perfectly free from the taint and suspicion of "*jobs* of this kind."

I cordially echo your opinion, "that it should be the *common property* of the members;" such it is intended to be; and, if the laws are not sufficiently comprehensive on that point, any friendly suggestions that would render them more explicit, will be hailed with gratitude by the Committee.

The conciliation of the "higher classes" is to me (as an individual) of no moment; I am anxious only to promote that union among my fellow-operatives, that shall carry with it in its development a forcible demonstration of their moral power; they have been too long degraded, carrying about the *Cain mark* of oppression and injustice, and fatally snared into intemperance, that they may be robbed of their birth-right by men who, because they compose "the higher classes," have no fellow-feeling with them, and dread the possession of a power which would destroy much of that insolent array of splendour and misery, profusion and want, idleness and toil, which disgrace the land of our birth. I would myself choose to see the working men release themselves without the foreign aid which some desire. I respect the higher classes, so long and so much as they fulfil the end of their creation; beyond that they cannot be, to a right thinking mind, aught but objects of contempt. There are exceptions, and I am glad to make and to know them individually; and, after all, what is the sum and substance of their conciliation to do? To admit them to the government of a hall

which is based on a demonstration of the *bundle of sticks*, because *labour* is too ignorant to manage its own dearest interests. Out upon the sophistry which would cloak all aristocratical intervention in an affair so important. The working man cannot be taught more than he knows at present of the misery of his condition; and, if he is wise enough to avoid the political Ahithophels of the day, he may build a Trades' Hall, use it as his castle, and leave it to his family as a heir-loom of industry.

I beg to apologize for this intrusion of honest opinions, and shall learn with delight, that an insight into the laws of our Company has produced any modification of your sentiments towards it.

I am, Sir,
Your obedient servant,
WM. FARREN, Sec.

Trades' Hall Office, 16, Old Bailey,
16th March, 1840.

We are much gratified with the courteous tone and firmness of purpose displayed in the foregoing communications; and we cordially respond in the same kindly spirit, not to maintain, through thick and thin, the opinions we before expressed, merely because we did express them, but to set forth to our readers the important facts which were not communicated to us at the time we wrote our former remarks. We perfectly agree with the worthy secretary on one material point, viz., that the operative members of the Institution should be effectually secured from the dictation, or influential interference of a class whose interests, if not opposed to those of the working men, are, at all events, totally distinct from them. This object, we are now informed, is effected by protecting clauses introduced into the laws for the constitution and government of the Trades' Hall. We transcribe the following, which are sufficient to show in what spirit these laws have been framed:—

"1. That, in order to promote the moral and social improvement of the working class, and to secure the erection of a Trades' Hall in some central part of London, where the meetings of trades may be better and more economically accommodated than at public houses, a capital of 15,000*l.* be forthwith raised by 15,000 shares of the value of 1*l.* each.

2. That, as a guarantee to the working class for the permanent security and acknowledgment of its interest in such Trades' Hall, and to give it a preponderating influence in its government from time to time, two-thirds of the whole number of shares shall be constantly in the possession of trades, &c., and individual operatives qualified to vote as hereinafter defined.

24. That all transfers of shares by trades, &c., or individuals, shall be effected by the Council for the time being, and shall be duly registered on payment of a fee of one shilling and sixpence; provided that the buyer of the shares so transferred, is in every case accepted by a majority of the Council; in which case he shall be furnished with a certificate of such registration, and a copy of these laws.

25. That the names of all persons proposing to accept shares by transfer, shall be submitted by the seller to the Council (in writing), for approval; and, in the event of any rejection by that body at any of its meetings, it shall be eligible for not less than one hundred shareholders to demand, by a written requisition, addressed to the Trades' Hall secretary, a ballot of the whole Council on the question at issue; and such ballot shall take place within seven days after the presentation of such requisition.

28. That, on the occasion of each and every ballot, every shareholder shall be entitled to one vote and no more, without reference to the number of shares which may be registered to him individually.

44. The Council shall consist of three members for every 1000 shares, making, in the whole, forty-five, who shall be elected at each annual meeting of the shareholders by ballot, two-thirds of whom shall belong to the working class, provided that no person shall be eligible to a seat in the Council, unless being, at the time of such election, a registered shareholder; and that the names of the Council, after every such election, be exhibited constantly in some public part of the Trades' Hall.

45. That every shareholder duly registered, shall be eligible to be elected on the Council, without reference to the number of shares held by him.

60. That in the event of any buyer of shares being, in the opinion of such registration committee, an improper party to be admitted into the Trades' Hall Proprietary; they shall report the same to the Council at its next meeting, and such Council shall decide on the admission or rejection of every such buyer, subject to the conditions of appeal by ballot against every such decision as are defined in these laws."

This appears to us quite satisfactory, and a sufficient security for the independence of the operative members.

With regard to the Society assuming a

character more or less political, that must, to some extent, depend upon the members themselves, rather than upon the laws of the institution. We think it would be expedient and beneficial to the working men, to confine their deliberations to subjects and laws which directly concern them as artizans, and not enter the labyrinth of general politics;—this, however, we merely give as an opinion, not as a ground of opposition, should they choose a different course. Our conviction of the expediency of seeking to command consideration and respect, rather than creating alarm, is unshaken; but when we speak of "conciliating the higher classes," we intend no more than that a good understanding should be cultivated on both parts; and nothing is farther from our wish, than to see an aristocracy of any denomination meddling with the government of the Trades' Hall—on the contrary, we advised that the administration of the Society's affairs should be vested solely in *bonâ fide* operatives.

The legitimate object of an establishment of this nature is, to impart respectability, and afford accommodation and protection to the meetings of the various trades, and to instruct and moralize, while it defends and advances the more immediate and material interests of the classes for whose benefit it is instituted. We do not doubt that such are the views of the Committee; but we think the success of the undertaking would be promoted by an address to the working classes, explaining the proposed administration and interior regulations of the Society. It is desirable that the privileges and benefits offered to the shareholders should be clearly defined, and the conditions upon which non-proprietors might be admitted, and other such details fully explained; it would also prevent many future dissentions and bickerings, if it were at once declared to what extent the Society is intended to act as a political party, and what guarantee will be offered, that political discussions shall not degenerate into unlawful and seditious meetings. We do not wish to exclude politics, but we most earnestly recommend that such subjects should be confined within what we conceive to be their proper limits. Let us suppose, for instance, that the introduction of some foreign article should, by its cheapness, or by any peculiarity, supercede the British manufactured article, and throw a number of workmen out of employment; the master manufacturer and the merchant, with their capital, can easily find other sources of profit; but the artizan, who is, perhaps, acquainted with no other trade, is exposed to utter ruin, and has no other hope but the removal of the cause of his distress. In such cases, the workmen should assemble, set forth their grievances, memorialize the Minister, and petition Parliament; and if the persons who are sent to Parliament to advocate the cause and defend the rights of the people, so far betray their trust as to grant no redress, more influential persons must be applied to, and the "honourable House" must be again petitioned and "*ever prayed*" to, till they do grant it. This, and *any question which especially regards the working class*, we consider fit subjects for their deliberations, and for the exertion of their utmost energies; but if they suffer themselves to be decoyed into the stormy regions of party politics, they will find their best interests merged in the turmoil of contending factions, and discover, when it is too late, that they have unknowingly been made the tools of intriguing ambition, and they will be deserted by those who pretended to be not only their best, but their only friends.

We trust that these remarks, whether they be or be not in accordance with the opinions and intentions of the Committee, will be received as they are intended—not as the arguments of an adversary, but as the suggestions of a sincere friend, dictated by an anxious solicitude for the welfare of the working classes, not only of this city, but of the whole country.

To the Editor of the Mechanic and Chemist.

Sir,—Noticing your important critique on the proposal to erect a "London Journeymen's Trades' Hall," in my mind unexceptionable, not only from the example you refer to in Geneva, but from your concluding remarks, I feel myself really indulging the hope of forwarding your honourable designs.

You reckon on donations, though not exclusively; my present is chiefly to intimate, while I despair not of others. A hard-working man has left in my hands 10*l.* of his savings, as it appears, from pure fulness of heart, finding himself prepared to spare it towards the cultivation of the plant under your direction, or where there can be found one so well qualified, as soon as it takes root.

Aquemolus.

39, Brunswick Street, Blackwall.

We have taken the liberty of omitting that portion of our worthy correspondent's letter which relates to his political opinions, not because we condemn them, but

because such subjects are entirely foreign to the objects of this work; and we always avoid them, unless the interests of those whose cause we advocate, require such occasional allusions as we were compelled to admit in our foregoing remarks. We cannot help admiring, as every one of our readers must do, the disinterested zeal which has induced our friend to sacrifice so considerable a sum for the benefit of his fellow-workmen. We feel a gratification in having inspired that confidence which it will ever be our pride to deserve; but we cannot recommend a measure which under present circumstances would be calculated to create disunion, and let these words never be forgotten—*union can only be preserved by mutual concession.*

Let us wait for farther information concerning the projected Trades' Hall, which we do not despair of seeing rendered unexceptionable to all parties; in the mean time, and upon all occasions, let good fellowship be cultivated and prized above all other things: let every man support his fair portion of the burden in all undertakings for public benefit, and let zeal be tempered with caution and discretion. The great diplomatist Tallyrand was never zealous; he once addressed the following words to the persons employed under him in an important department:—"Gentlemen, I only require of you the faithful discharge of your several duties; I desire that you should not be zealous—gentlemen, I hate zeal."

IMPROVEMENTS IN THE ARGAND LAMP.

BY SIR J. F. HERSCHEL.

The following simple, easy, and unexpensive mode of greatly increasing the quantity of light yielded by a common Argand burner, has been used by me for some years, and is adapted to the lamp by which I write, to my greatly-increased comfort. It consists in merely elevating the glass chimney so much above the usual level at which it stands in the burners in ordinary use, that its *lower* edge shall clear the *upper* edge of the circular wick by a space equal to about the fourth part of the exterior diameter of the wick itself. This may be done to any lamp of the kind, at a cost of about sixpence, by merely adapting to the frame which supports the chimney four pretty stiff steel wires, but in such a manner as to form four long upright hooks, in which the lower end of the chimney rests; or, still better, if the lamp be so originally constructed as to sustain the chimney at the required elevation without much addition, by thin laminæ of brass or iron, having their planes directed to the axis of the wick. The proper elevation is best determined by trial; and, as the limits within which it is confined are very narrow, it would be best secured by a screw motion applied to the socket on which the laminæ above mentioned are fixed, by which they and the chimney may be elevated or depressed at pleasure, without at the same time raising or lowering the wick. Approximately it may be done in an instant, and the experiment is not a little striking and instructive. Take a common Argaud lamp, and alternately raise and depress the chimney vertically from the level where it usually rests, to about as far above the wick, with a moderately quick but steady motion. It will be immediately perceived that a vast difference in the amouut of light subsists in the different positions of the chimney, but that a very marked and sudden *maximum* occurs at or near the elevation designated in the commencement; so marked, indeed, as almost to have the effect of a flash if the motion be quick, or a sudden blaze as if the wick-screw had been raised a turn. The flame contracts somewhat in diameter, lengthens, ceases to give off smoke, and attains a dazzling intensity. With this great increase of light, there is certainly not a corresponding increased consumption of oil: at least the servant who trims my lamp reports, that a lamp so fitted consumes very little, if any more oil than one exactly similar on the common plan.—*Phil. Mag.*

SUCCESS OF THE PENNY POSTAGE.

The practical results of the penny-postage experiment, so far as they have been ascertained and published, are very satisfactory. First as regards revenue. It will be remembered that Mr. Herries, who professed to have some acquaintance with the business of the department, estimated the loss to arise from the change in the rates of postage at from 1,200,000*l.* to 1,400,000*l.* Now it appears from a Parliamentary paper delivered this week, that the amount of postage collected in the London district was,

From Jan. 10th to Feb. 13th, inclusive	£60,060 14 8
The amount collected during the same period of 1840, being that in which the penny postage first came into operation	40,527 8 7
	19,533 6 1

The decrease of receipts has been less than one-third. Now if the same proportion holds good throughout the country, the loss will be only about half of Mr. Herries' calculation.

The gross revenue of the Post-office may be put down at, in round numbers, ...	£2,000,000
One-third (sinking the fractions)	666,666

It must be remembered that the plan has not had a fair trial. In the first place, it is as yet imperfectly developed. The stamped covers are not ready, and the inconvenience of sending a penny with every letter continues. The stagnation of trade has been remarkable; and the holiday on the Queen's marriage diminished the number of letters in the London district for the week in which it occurred by no fewer than 70,000.

But we regard the revenue question as subordinate to other considerations. Penny postage was not desired for the purpose of swelling the Treasury coffers, but for increasing the means of intercommunication. And it is indeed encouraging and delightful to mark how extensively this benefit has arisen from the reduction of rates.

The number of letters for the period between Jan. 10th and Feb. 13th, 1839, was	930,215
For the same period in 1840, under the penny rate	2,286,385

We have made some inquiries as to the sources of this enormous increase, and are glad to learn that, to a considerable extent, it is attributable to the correspondence of the humbler classes, in their various capacities.

So far then the great experiment works well, and bids fair to confound the croakers.—*Spectator.*

CHEMICAL AND PHILOSOPHICAL SOCIETY,

236, HIGH STREET, SHOREDITCH.

To the Editor of the Mechanic and Chemist.

SIR,—After the letter of Mr. R. S. Jeffs was sent to your paper for insertion last week, the provisional committee of the above-named Society determined to postpone the opening for a short period. It was, therefore, not done on Wednesday last, as stated in No. 84 of your Journal, but is expected to take place on or about the 15th of next month, of which you will be kind enough to allow us to give notice. In the mean time, anyone willing to join the above Society, will please to forward his address (post paid), either to Mr. R. S. Jeffs, 81, Shoreditch, or to me.

I remain yours, &c.,
H. WIGLESWORTH, Sec.

65, Tooley Street.

P.S. The subscription is fixed at 8*s.* per annum.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 8, W. Rider, Esq., on Engraving. Friday, April 10, G. F. Richardson, Esq., of the British Museum, on Corals, and the Marbles they compose. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, April 9, T. Downing, Esq., on Photogenic Drawing, and the Daguerreotype, with Illustrations. At eight o'clock.

QUERIES.

How India-rubber can be dissolved, so as to make it into any form you may wish?

T. H. B.

The process of embossing on leather; how are the lines and figures stamped on, and the gold leaf applied? Also, how are the colours prepared and applied to the edges of books?

H. B. N.

How ginger-beer fountains act? And a receipt for making ginger beer for the fountain?

T. M.

TO CORRESPONDENTS.

W. N. *is mistaken; and* L. L. *has given the true solution of the problem. For by the question,* L *l*, *l l′*, *l′ l″*, *&c., are equal spaces, and* P *p*, *p p′*, P *p″*, *&c., are also equal spaces; join p l*, *p′ l′*, *&c., and they will all be parallel to* P L, *since they all point to the north; and* P C *is a straight line, because no curve will fulfil the above conditions.*

S. Wilson.—*Quicksilver may be separated from silver, by submitting the amalgam to a red heat. If it be required to collect the mercury, the crucible must be covered, and a tube inserted to convey the vapour into any convenient vessel as a receiver.*

Our Artist being unable to complete the Engraving of the

PALACE OF THE QUEEN

AND PRINCE ALBERT,

which we promised last week, we are compelled to defer its appearance till next week.

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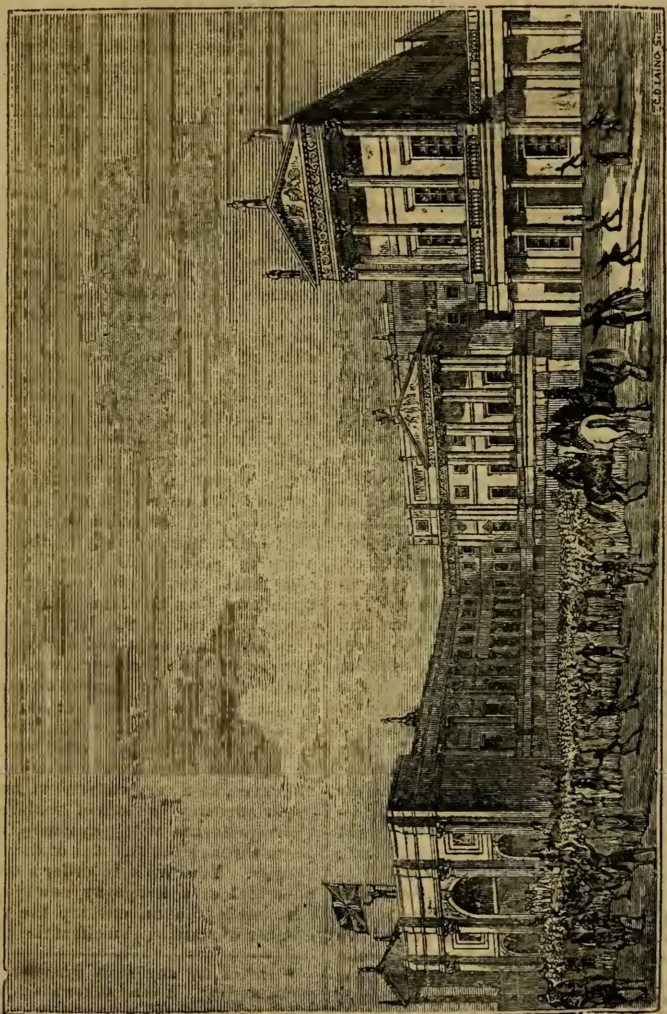
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 86 & 87, NEW SERIES. | SATURDAY, APRIL 11, 1840. (PRICE TWOPENCE.) | Nos. 207 & 208, OLD SERIES.

BUCKINGHAM PALACE.



City Press, 1, Long Lane, Aldersgate Street · D. A. Doudney.

BUCKINGHAM PALACE.

(See Engraving, front page.)

The "interesting event" which has elevated the Prince Albert to the exalted station he now occupies, has induced the proprietors of numerous periodical publications, to present their readers with portraits of her Majesty and her Royal Consort; our reasons for not doing so, will, we trust, be considered by our readers as amply sufficient to justify us in pursuing a different course. It is not only because the representation of a work of art is best adapted to the character of this publication, but because we trust our readers will have frequent opportunities of contemplating her Majesty's effigy, not only in silver, but in those eminently useful discs of gold, which bear the portrait, as well as the title and the power of the *sovereign*. We have also a motive of economy; for it is not unlikely that, at some future period, we shall be able to produce a single portrait, which will combine the likeness of both those illustrious personages.

Buckingham palace, after many years' delay, and the expenditure of vast sums of money, was completed, and became a royal residence, by her present Majesty's taking possession of it shortly after her accession to the throne, viz., July 13, 1837. Its situation is unfavourable to the display of any effect of grandeur when viewed from a distance; and the structure of the building is not calculated to overcome, in any degree, the disadvantage of its position. A stranger would never suspect that it was the palace of the Queen of England; it appears, from a distance, much more like a palace of united parishes, than of united kingdoms. The apartments are by no means spacious, and they are too limited in number. We have, however, taken a view which shows it to the best possible advantage, and upon the joyful occasion of her Majesty's marriage. The dimensions are as follow:—Width of wings, 150 feet; depth of wings, 140 feet; width of ditto in front, 49 feet; extent of front, including wings, 238 feet; extreme length, including the ground-floor addition to the wings, 432 feet. The height of the Doric order and its socle, is 26 feet; and from its cornice to that of the Corinthian order, 40 feet; making the entire height 66 feet, exclusive of pediments, &c.

The marble arch and bronze gates have incurred the same universal censure as the edifice itself; we can only say that it is an inelegant and utterly useless mass of marble and metal.

PENNY-POSTAGE STAMPS.

The enemies of this great and popular measure are beat at every point; their arguments are exhausted, and their rage has subsided into sullen desponding melancholy. There may be, and we believe there are, some whose incorrigible malignity still strives to deprive the people of the vast benefits which the cheap postage has conferred upon them; to these we shall at present only say, with the points of our pens we have gained it, and with the points of our pens we will defend it.

The arrangements for issuing the different kinds of stamps are now nearly completed; but it is expected that they will for the present only circulate in the London district, formerly the twopenny post. The following is from the "London and Westminster Review":—

"Each kind of stamp has, in truth, its own peculiar advantages. The adhesive stamp has portability to recommend it; twenty shillings' worth of postage will not weigh half-an-ounce, and will occupy scarcely a perceptible space in a pocket-book. Its lightness is such, that it hardly adds to the weight of a letter. It may be attached to letter paper of any kind, either before or after the letter is written. It saves trouble: being purchasable at the Post Office, it may be attached to a letter at the very time when the letter is posted, and a single journey to the Post Office to post the letter must at all events be made. One real objection to the exclusive use of stamped covers is, that the Post Office stamp, certifying the date and place of posting the letter, which are sometimes wanted in evidence, would upon that plan be affixed only to the envelop, and not to the letter it encloses. This objection does not apply to letters franked by the adhesive stamp. It is also the best suited for parcels or letters exceeding the lowest weight; as, on ascertaining at the Post Office the proper amount of postage, additional stamps may be at once affixed. These stamps will, moreover, be a very convenient and novel paper currency for sums of small amount.* Correspondents will pay small debts of pence through the medium of these penny stamps. You wish to order a twopenny pamphlet or a fivepenny newspaper; by transmitting in an envelop the required number of stamps, you effect the payment,

* Indeed for any sums whatever under a pound sterling. A sheet of the adhesive stamps, *minus* two cut off, will be good paper for 18*s*. 10*d*.; a sheet, *minus* five, will be good for 18*s*. 7*d*., and so on.

which, for such sums, there are no ready means of doing at present. The cost of manufacturing these stamps will be sufficiently low to enable Government to sell them, in all parts of the country, for the penny only; whereas the price of a single cover, including the penny for postage, cannot well be less than 1¼d.

The greatest recommendation of the stamped cover is, the facility it affords to the poor man of obtaining at every post-office a cheaper piece of writing-paper than he has ever before been able to buy. For a farthing he will buy paper sufficient for most of his letters. This accommodation will exercise to some extent a beneficial influence on the habit of letter-writing, and on the amount of postage, particularly in rural districts, where letter paper is now sold of a bad quality and high price at the huckster's shop, which supplies the miscellaneous wants of a whole district. Mr. J. W. Parker, the extensive publisher, pointed out to the Committee the manner in which the stamped covers will be used as trade circulars. A tradesman would print upon the inside of a cover a list of his goods for sale, and on the outside his own address, whereby he would secure to himself the exclusive use of it. He would then enclose these circulars to his connexions, who would mark against each article the quantity required, and remit the circular by post to the sender. * * *

It has always been contended, that beauty of design and workmanship is one of the best securities against forgery. This is at last felt even by the Directors of the Bank of England, and a new Bank-note is in preparation from a design by Sir Richard Westmacott, to be engraved by J. H. Robinson, and is expected to contain every beauty which art is capable of giving to it. What will be in this respect the character of the postage stamps, may be inferred from the artists who are employed in the production of them. We need only mention the names of W. Mulready, W. Wyon, J. Thompson, C. Heath. The idea of calling in the powers of art as auxiliary to the philanthropic agency of the penny post, is a happy one. Such an opportunity of spreading models of beauty over the whole face of the country (we might almost say the world), and among all classes of the people, has never occurred before in the history of mankind. Never before has artist had so glorious a host of spectators for his efforts, and the distribution of hundreds of millions of a beautiful object, cannot be without its effect on the education of the public taste. The Chancellor of the Exchequer could not have selected four artists more suitable for his purpose. The designs on the die in the hands of Mr. Wyon, and on the plate in the hands of Mr. Charles Heath, have been stated to be the head of the Queen. Mr. Wyon's die is, we presume, intended for the letter paper, and Mr. Heath's plate for the adhesive stamp. A forgery of the work of either of these distinguished artists, to deceive (as it must do to be effectual) an experienced eye, would be a work we should very well like to behold. The mechanical execution, both in stamping and printing, will, it is fair to suppose, do justice to the performances of these artists; and such processes have of course been adopted, as to insure perfect identity in the numerous dies and plates which will be necessarily wanted. Of Mr. Mulready's design, which is confided to Mr. John Thompson, we can speak in the highest terms. In less than half the usual space for the face of a letter, the artist has placed groups of upwards of forty figures. In the centre is Britannia, in the act of despatching four winged messengers. The figures on each side of her, are groups emblematical of British commerce, and communication with all parts of the world. On the right are East Indians on elephants, directing the embarkation of merchandise; next Arabs, with camels laden; next Chinese; on the left, American Indians concluding a treaty, and negroes packing casks of sugar. The whole design occupies rather more than an inch in width along the face of an ordinary envelop. In what may be called the foreground on the one side, a young man is reading a letter to his mother, whose clasped hands express her emotion at its contents; on the other side, is a group of three figures, each one eagerly pressing around to read, or, at least, catch a sight of the welcome letter. The whole conception forcibly tells its story, and suggests emotions of gratitude at the universal blessings that flow from unfettering correspondence, which is but speech by means of written characters. As a work of art, in respect of composition and characteristic portraiture, it is eminently successful. The national peculiarities of attitude and costume, though expressed by outline only, are so well preserved, that each group may be instantly recognised. The whole design is like a pen-and-ink sketch by a distinguished artist, as far removed as possible from the common-place designs usually employed in analogous cases. And, considering the small space, the mode of

printing to be employed, and other circumstances necessarily fettering the artist's powers, we think that artists and the public will agree with us, that Mr. Mulready has produced the very best work of art consistent with the conditions within which, by the nature of the case, he was confined."

LIFE ASSURANCE.

NO. III.

RATES OF PREMIUM.

WHAT has been already advanced on the subject of life assurance, it is hoped the reader will re-peruse, previous to the investigation of this chapter, as the subject last treated deserves the most careful observation. Let us, therefore, notice farther, for a moment, that the plan there stated, as being universally adopted by the life offices, is the only method for assuring a just and equitable proportion among those who may become assurers; for, as was stated, if sufficient was taken from each person wishing to assure his life, to cover the *expected* claim at an *expected* period, without allowing a portion of the interest accruing to form a part of such payment or annual premium; then the office following such a course, would realize immense gain,* and the assurer's real claim would even exceed the sum adduced by a simple statement in proportion: for example :—12 : 12*l.* 2*s.* 7*d.* :: 500*l.* : 670*l.* 16*s.* 8*d.*; or, more than 170*l.* 16*s.* 8*d.*, beyond the sum stipulated to be paid.

It is precisely upon the principles which the societies choose for their guidance in respect to the duration or expected term of a person's life, that they are enabled to assure a life for one year only, at a much less premium than has been named ; for example, at the age of thirty, a person would have, generally, 16*l.* 15*s.* to pay down, which would assure his family 1000*l.*, should he die before the expiration of the year. Now the remarks before made will hold equally good in this case; for suppose 10,000 persons were to make this assurance at the same age, by the Northampton table, 171 would die in the course of the year, and their claim would be 171,000*l.*; therefore the premium each had paid the society, would require to be placed at interest ; for observe, all premiums should be paid at the commencement of the year, and 2*l.* 1*s.* 9½*d.* per cent. interest added to such premium, would then cover their claim ; while the surplus interest which every society would be able to make beyond 2*l.* 1*s.* 9½*d.* per cent. would form a part of the accumulating fund of the society. We admit the success of any society would be greater as the numbers of the assurers increased, so far as respects the interest to be gained by the use of their premiums; but a greater advantage would occur upon the probability of fewer deaths happening, than stated in the present estimate ; still, the probability which here exists in favour of the office, is counterbalanced by the fact, that not a thousand persons do in one year join a single life-assurance society, upon any of the plans which they offer to the public.

We think this truth may prove of service to many, inasmuch as hundreds are daily called away from their families and dearest connexions, without having made the slightest provision for such a calamity ; and particularly do members of the various professions and mechanics feel this, since their means are the most precarious, however long their lives.

It may be stated, with some degree of confidence, that at every age a premium can be estimated for a society's use without material error ; so that for each person a fixed rate shall appear. For the term average would be unjustly applied to this purpose, that is, to the equalisation of various ages to one price,* since we have such a multitude of evidence on the subject in this enlightened age. But there may be mistakes arising from ignorance, in framing a table of premiums upon any given expectancy of life. It is common with most offices to assume some table of mortality throughout, that is, for their

* The Equitable Society, in 1771, charged for assuring a person aged twenty, 100*l.* at death, the sum of 3*l.* 9*s.* 4*d.* per annum, which was, in 1779, reduced to 2*l.* 12*s.* 10*d.*; and subsequently, when they found their fund rapidly on the increase, it was reduced to 2*l* 3*s* 7*d*. The following remark of Mr. Morgan, the eminent actuary of that society, may support this statement:—"For the first twenty years the society possessed such an excess of income, that, being suffered to accumulate without interruption, it contributed, in a great measure, to form the basis of its future opulence."

* The Amicable Society, which, in the year 1760, was the only one existing, was originally founded rather on principles of mutual benevolence, than of mutual assurance, as now understood. A certain number of persons (the only restriction being, that their ages should be between twelve and forty-five), each paying the same sum yearly ; the whole fund of each year, or the greater part, was divided among the representatives of those who died within the year.—*De Morgan on Probability*.

younger, middling, and older ages. They likewise adopt a fixed ratio of interest per cent., by which the premiums are reduced to the assurer in manner before stated, and this is likewise calculated upon the whole table; so that premiums estimated upon the Northampton tables of mortality, reckoning a high rate of interest (or discount, more properly) to reduce such premiums; and such as were calculated upon the Carlisle tables, with a low rate of discount, would resemble each other in the middle ages of life; but a disparity, or difference of premium, would appear at a more advanced age. Hence appears the fact, that the older ages are not so well known as those which precede, and of which there has undoubtedly been greater opportunities of judging. Under these circumstances, therefore, the advantages and disadvantages which spring from the actual experience of societies long established, and the tables of mortality, respectively, require to be placed in juxtaposition, to attain that degree of truth necessary for fixing a rate of premium for the older ages; or the ratio of discount should be somewhat increased.

Let it be thoroughly understood, that the world has now sufficient evidence before it, to compute any table a society might require without risk; and that a low rate of interest should be calculated upon is obvious, since the premiums would be higher, and a mistake on any point, not too important, might thus be compensated by the society dividing its gains among all the members; as is the case in the Equitable, the Mutual, and some others.

For the present, it cannot be denied, that much confidence (we would say credulity) is required to enable many of the societies which have sprung up within the last few years, to gain assurers; but the errors which exist in some, are caused, probably, by the mistakes to which we have alluded. An investigation of all their rates of premium is desirable, however, provided persons are not led, by their seeming bright promises, to follow *cheapness* in preference to *stability*. This last qualification is certainly the standard to which we would point; and, by way of conclusion, we give the tables of three offices, whose premiums are quite as low as can be prudently recommended, considering they divide all their profits; a subject which we must consider in our next chapter.

Age.	Metropolit			Mutual.			National Provident.		
	£	s.	d.	£	s.	d.	£	s.	d.
15	1	15	8	1	15	7	1	15	2
20	1	19	6	1	19	11	1	19	4
25	2	4	0	2	4	7	2	4	3
30	2	9	9	2	10	2	2	10	2
35	2	17	5	2	17	5	2	17	5
40	3	6	4	3	7	6	2	6	3
45	3	18	11	3	17	11	3	17	4
50	4	12	0	4	12	7	4	11	1
55	5	9	1	5	14	4	5	8	8
60	6	11	6	7	2	0	6	11	10

SIGMA.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 235.)

NORTHAMPTON is pleasantly situated on an eminence, at the foot of which is the river Nen. It contains four churches; All Saints', St. Sepulchre's, St. Giles's, and St. Peter's. The principal one, All Saints', is situated in a central part of the town, at the meeting of four spacious streets. It has a portico of eight Ionic columns, with a statue of King Charles II. on the balustrade, erected to perpetuate the gratitude of the town for the munificence of that monarch, who granted 1000 tons of timber, and seven years' chimney-money, towards repairing the church, which was completed in 1712. It contains a statue, by Chantrey, of the Hon. Spencer Percival. St. Sepulchre's is an ancient struc-

ture, supposed to have been erected by the Knights Templars, and copied from an erection over the Holy Temple in Jerusalem. It is of a circular form, with a cupola in the centre, supported by eight Norman pillars. St. Giles's possesses no remarkable feature to interest either the antiquarian or the architect; but St. Peter's is a curious relic of ancient architecture. This town also contains a very spacious and handsome market-place, and several elegant public edifices; the streets are regular, and the houses built of stone, and mostly slated. A race-course was formed in 1778, and the races held there annually in the autumn, are well attended. The proximity of the Roade and Blisworth Stations, each about five miles distant, has reduced the time of a journey to London (66 miles) to little more than three hours. The river Nen unites with numerous canals, and forms communications by water to the German Ocean, London, Liverpool, and Bristol.

Northampton is considered the greatest manufactory of shoes in the world, and many thousands of men, women, and children, are thence supplied with profitable, and almost constant employment. This manufacture extends over a great portion of the county, not only in large towns, such as Wellingborough (that strong hold of true English hospitality), but in the remotest villages. There were formerly seven churches in Northampton, but three of them were destroyed by the great fire. There were also monastic establishments of Franciscans, Dominicans, Eremites, and Carmelites; these, too, are gone and forgotten, and their legends, their deeds, and their very names are lost in the mist of expiring tradition.

Weedon Station, a principal one, 69¾ miles from London, 42½ from Birmingham, is situated at a village called Weedon Bec, about five miles from Daventry. This village is also called Weedon-in-the-street, from its being situated on the Roman way, called Watling Street. The Grand Junction Canal passes close to Weedon churchyard, upon an embankment thirty feet high, reaching above the body of the church, and nearly on a level with the bells. One of the most extensive military depôts in the kingdom, is established at Weedon; regiments returning from unhealthy climates, are frequently sent to this place for the benefit of its remarkably pleasant situation and healthy climate.

From Weedon, the railway is continued first through a cutting of considerable depth, and afterwards upon an embankment, with a gradual rise, till it crosses the Grand Junction Canal on the Long Buckby Viaduct. From this point it proceeds in nearly a straight line to

Crick Station, an intermediate one, 75¼ miles from London, 37 from Birmingham. Passing over a viaduct at Crick Station, the railway proceeds through a deep cutting to Kilsby Tunnel, the longest upon the line, being one mile and 640 yards in length. Immense difficulties were opposed to the completion of this Herculean undertaking; the nature of the strata was extremely unfavourable to the execution of the work, and the great quantity of water which issued from numerous springs was a serious impediment, and required the constant assistance of powerful steam-engines to prevent its accumulation. The occurrence of a quicksand of considerable extent, was also a formidable obstacle; but every difficulty was triumphantly surmounted, though at an immense expense to the Company. About a mile beyond this tunnel, the line passing through a deep cutting, quits the county of Northampton, and enters Warwickshire, at Hill Moreton Viaduct, which passes over the turnpike road and Oxford Canal; it then proceeds upon the Hill Moreton embankment to

Rugby Station, a principal one, 83½ miles from London, 29 from Birmingham.

Rugby is a market town in Warwickshire, 83 miles from London, 13 from Coventry, and 16 from Warwick. In Doomsday Book, the name of this place is written *Rocheberie*, which signifies a noble habitation on a rock, or quarry of stone. It possesses an excellent and richly endowed school, founded by Lawrence, Sheriff of London, grocer or haberdasher (terms which appear to have been nearly synonymous in the 16th century, both signifying a retailer of small wares), in the ninth year of the reign of Queen Elizabeth. It is curious to trace the gradual, but enormous increase in the value of the property bequeathed at that period. A portion of the property left for the support of the school, was eight acres of land, situated in Lamb's Conduit Fields, *near* London, and termed the Conduit Close. The value of this land was so small, that in 1686, the whole Lamb's Conduit property, consisting of 24 acres, was let for the annual rent of 50*l.*, and a lease granted for 50 years; another lease was afterwards granted for a term of 43 years, at 60*l.*; and, up to 1780, the whole revenue of the institution amounted to only 116*l.* 17*s.* 6*d.*; but soon after the extended term of lease was granted, projects

of building were entertained, and the metropolis extending in that direction, it was computed that a ground-rent of 1600*l.* would accrue to the charity on the expiration of the lease. Since that period, the value has so rapidly increased, that, at the present time, the Lamb's Conduit estate yields no less than 5000*l.* per annum. In 1808, it was decided by the trustees, that an entire new edifice should be erected, and their intentions were speedily carried into effect. The present building is in the Elizabethian style, of vast dimensions, and well adapted to the objects for which it is intended.

ON THE SOURCE OF POWER IN THE VOLTAIC PILE.

At a recent meeting of the Royal Society, a very interesting paper was read, establishing an important fact in electro-chemistry, by M. Faraday, Esq.

The determination of the real source of electrical power in galvanic combinations, has become, in the present state of our knowledge of electricity, a question of considerable importance, and one which must have great influence on the future progress of that science. The various opinions which have been entertained by philosophers on this subject, may be classed generally under two heads; namely, those which assign as the origin of voltaic power, the simple contact of dissimilar substances, and more especially of different metals; and, secondly, those which ascribe this force to the exertion of chemical affinities. The first, or the theory of contact, was devised by Volta, the great discoverer of the voltaic pile; and adopted, since it was promulgated by him, by a host of subsequent philosophers, among the most celebrated of whom may be ranked Pfaff, Marianini, Fichner, Zamboni, Matteucci, Karsten, Bruchardat, and also Davy; all of them bright stars in the exalted galaxy of science. The theory of chemical action was first advanced by Fabroni, Wollaston, and Parret; and has been since farther developed by Oersted, Becquerel, De la Rive, Ritchie, Pouillet, Schonbein, and others. The author of the present paper, having examined this question by the evidence afforded by the results of definite electro-chemical action, soon acquired the conviction of the truth of the latter of these theories, and has expressed this opinion in his paper, published in the Philosophical Transactions for 1834. The author, after stating the fundamental doctrine laid down by Volta, proceeds to give an account of various modifications in the theory introduced by subsequent philosophers; and also of different variations in the views of those who, in the main, have adopted the chemical theory. Being desirous of collecting farther and more decisive evidences on this important subject, he engaged in the series of experimental researches which are detailed in the present memoir. It is assumed, he observes, by the advocates of the contact theory, that although the metals exert powerful electromotive forces at their points of mutual contact, yet, in every complete metallic circuit, whatever be the order or arrangement of the metals which compose it, these forces are so exactly balanced, as to prevent the existence of any current; but that, on the other hand, fluid conductors, or electrolytes, either exert no electromotive force at their place of contact with the metals, or, if they do exert such a power, the forces called into play in the complete circuit are not subject to the same law of compensation, as obtains with circuits wholly composed of metallic bodies. The author successfully combats this doctrine, by bringing forward a great number of instances where certain fluids, which have no chemical action on the metals with which they were associated in the circuit, are in themselves such good conductors of electricity, as to render evident any current which could have arisen from the contact of the metals, either with each other or with the fluid: the evidence of their possessing this conducting power being their capability of transmitting a feeble thermo-electric current from a pair of plates of antimony and bismuth. The following he found to be fluids possessing this property in a high degree; namely, a solution of sulphuret of potassium, yellow anhydrous nitrous acid, mixed with nearly an equal volume of water, very strong red nitric acid, and a mixture of one volume of strong acid with two volumes of water. By employing the solution of sulphuret of potassium as an electrolyte of good conducting power, but chemically inactive with reference to either iron or potassium; and, associating it with these metals in a circuit, formed by two test-glasses containing the solution, into one of which was immersed a plate of platina and a plate of iron, and in the other two plates of platina; and the circuit being completed by wires of the same metals respectively, joining the iron plate in the first glass with one of the platina plates in the second, while the other two platina plates were united by platina wires, interrupted at one part by a

short iron wire which joined their ends. It was found by the test of an interposed galvanometer, that, as no chemical action took place, so no electric current was produced; yet the apparatus, thus arranged, could transmit a very feeble thermo-electric current, excited by slightly raising the temperature of the wires at either of their points of contact. Hence the inference may be drawn, that the contact of iron and platinum is of itself productive of no electromotive force. On the other hand, the author shows, that the interposition in the circuit of the smallest quantity of an electrolyte, which acts chemically on either of the metals, the arrangement remaining in all other respects the same, is immediately attended with the circulation of an electrical current far more powerful than the thermo-electric current above mentioned. A great number of combinations of other metals were successively tried in various ways, and they uniformly gave the same results as those of iron and platina. Similar experiments were then made with various metallic compounds, and also with other chemical agents; and in all cases the same general fact was observed, namely, that when no chemical action took place, no electrical current was excited; thus furnishing, in the opinion of the author, unanswerable arguments against the truth of the theory of contact. The only way in which it is possible to explain these phenomena on that theory, would be by assuming, that the same law of compensation as to electro-motive power is observed by the sulphuret of potassium, and the other fluids of corresponding properties, as obtains in the case of the metals, although that law does not apply to the generality of chemical agents; and, in like manner, different assumptions must be made, in order to suit the result in each particular combination, and this without any definite relation to the chemical character of the substances themselves; assumptions, which no ingenuity could ever render consistent with one another. At the conclusion of the paper, the author describes some remarkable alternations in the phenomena which occur when pieces of copper, or two pieces of copper and silver, or two of silver, form a circle with the yellow sulphuretted solution, and which leads to the same conclusion as the former experiments. If the metals be copper and silver, the copper is at first positive, and the silver remains untarnished; in a short time the action ceases, and the silver becomes positive, at the same time combining with sulphur, and becoming coated with sulphuret of silver; in the course of a few minutes, the copper again becomes positive; and thus the action changes from one side to the other in succession, and is accompanied by a corresponding alternation of the electric current.

It may be proper to state, that we are indebted to the "Athenæum" for the foregoing report.

BURNING COAL MINES.

Letters and papers from the department of the Allier, bring accounts of a remarkable conflagration which broke out in the coal mines of Commentry, on Sunday, the 15th ult., and had been burning for a week with daily-increasing fury. It appears that this fire, which, for the last four-and-twenty years, has been silently smouldering in the bowels of the earth—revealing its existence by perpetual smoke, and occasional outbreaks of flame, which, however, had always been confined within the limits abandoned to its dominion—had, at length, made its way through some breach into one of the vast galleries of these extensive workings; and there, meeting with the air-current so long denied it, had spread through all the subterranean chambers and passages with a rapidity, before which resistance became utterly powerless; showing itself at every crevice and outlet of the vast labyrinth, and flinging its points and columns of fire far up into the air, through all the shafts that led into the wide field of the rich deposit. Luckily, the solemnities of the day had emptied the workings of their human tenants; for no mortal aid could have availed them against the suddenness with which the fiery flood swept over all things. The authorities of the district were early on the spot, but have hitherto been little more than idle and awe-struck spectators. Neither Vesuvius, nor any other irruption, say the accounts, can give a notion of the dreadful and sublime scene. "If," says one writer, "it were possible to forget that the flames have been, for three whole days, devouring immense wealth, and that by this conflagration three hundred fathers of families will be thrown out of employment, there would be room for no other sentiment than that of admiration at the magnificent spectacle. Imagine a deep ravine, nearly circular, in the form of a reversed cone, with its edges, however, hourly enlarging. Through fourteen large openings, issuing at about twenty feet above the ground of this ravine, and giving access to the innumerable galleries of the mines below, as many

torrents of flame are poured forth with frightful violence from the cauldrons within—flames of a thousand hues, rushing forth like fiery whirlwinds—dividing, and crossing, and mingling, and rising, and falling, and rising again! At times, a hollow cracking sound echoes through the abyss; this is some huge block of coal detaching itself from the roof or sides of one of the galleries, and falling into the blazing gulf. Then rises up a thick column of black dust, till it reaches the openings of the galleries, where, pierced in all directions by the flames, long serpents of fire work through its volume from side to side. Sixty feet higher up, on each side of the galleries, two gaping mouths shoot into the air their dazzling columns of fire. Suddenly one of these ceases. It seems, for a moment, as if checked in its wrath. Then comes a long and startling groan from the entrails of the earth; and forth again rushes the flame, blood-red, roaring and terrible, threatening, in its fury, to lift up the burning mountain altogether, and bury the spectators beneath its dreadful ruins. Again, look around you; it is midnight, and two thousand human faces are there, some grouped on the opposite crest of the ravine, some sheltered in the cavities of the rocks. Yet no sound meets the ear save that of the roaring flames." The latest accounts state, that the rafters of the galleries had all fallen, and the founts of flame nearly ceased to play. The whole had become one huge burning gulf. The loss is said to be incalculable; millions of hectolitres of coal had been consumed. The engineers were preparing to turn the course of a stream, which flows at a league's distance, and direct it upon the burning mountain. Workmen were employed night and day in this operation, by which it was hoped to lay the mines under water.—*Athenæum.*

MICROSCOPICAL SOCIETY.

A paper was read by Mr. Edwards, "On the Structure and Affinities of the Bacillariæ of Ehrenberg." After commenting on the polygastric characters of these animalcules, the indestructible nature of their siliceous coverings, and their mode of reproduction by spontaneous division, the author proceeded to discuss the merits of these views, which have claimed for the Bacillariæ, on the one hand, a place in the vegetable, and, on the other, a position in the animal kingdom. The mixed nature of the phenomena exhibited by these animalcules, which has also led some naturalists to consider them as in one stage of their existence, animals, and in another, vegetables, furnish, according to the author, sufficient grounds for considering the Bacillariæ as an osculent group, uniting the two great kingdoms of nature.

DUBLIN MECHANICS' INSTITUTION.

The directors of the above Institution have issued an address to the working classes of the city of Dublin. As the conditions it offers, and the inducements it holds out, especially to the poorer class of working men, are very nearly the same as those in most of the English institutions, we produce it here, with the hope that it may tend to promote the success of those societies which we believe to be calculated not only to amuse and instruct, but materially and permanently improve the social condition of the working classes at large.

"ADDRESS.

"Friends and Fellow-countrymen,—We address you upon a subject that concerns you all, whatever trade you may follow, or whatever opinions you may hold. We have nothing to say that will offend any man among you; nothing that you cannot readily comprehend. Listen to us, then, for a very few moments, and see if what we tell you of may not be worth your while to know.

Two years ago, there was not in the entire city of Dublin a single room where a working man could go in the evening, to read an amusing book, or to learn anything new in the way of his trade. Many of you are, perhaps, unaware that any such institution exists now. It is our pleasure and our pride to tell you that there does; that one of the finest buildings in your beautiful city is devoted exclusively to the amusement and instruction of the operatives of Dublin. Come, then, and judge for yourselves what we are doing to improve one another, and whether you might not do worse than join us. Remember we are not speculators, telling you what *might be done*—we ask you to look at what we *have done*, and at what we *are doing*. Plain men, like yourselves, with very moderate means, but, putting together each man what he can spare, we have enough to accomplish a great many good things.

The Mechanics' Institute is an association for mutual instruction founded by mechanics, composed chiefly of mechan-

ics, regulated by mechanics, and, in the main, supported by the subscriptions of mechanics. Every man who pays half-a crown a quarter is a member. We, as well as you, know how hard the times are; but still, half-a-crown a-quarter is only twopence halfpenny a week; surely that is not too high a charge for admission to as good a reading-room—as well lighted, and as well supplied with every new and useful publication—as any in the kingdom; for the use, besides, of a well-chosen lending library, containing one thousand volumes of practical and amusing books; and, for admission to several courses of lectures during the year, upon various subjects, by men of ability and character. Is all this dear at half-a-crown a-quarter?

We have been trying the benefit of this mode of spending our leisure time, after business hours, as we told you, for now nearly two years; and we find ourselves amply repaid in more ways than one. We belong to different branches of trade ourselves; and what serves one cannot but serve another. We all contrive to benefit by the means of information thus placed within our reach; and we are convinced, that if you were to try, you would be benefitted also.

Surely it is time that men should cease labouring as mere unthinking, unreflecting machines? Ought not every man to know and understand the design and theory of the work he is helping to complete? Knowledge makes labour light, and enables a man to avail himself of every suggestion that the experience of other men may furnish. And let none say that the time for improvement is past. No one who is able to work is too old to learn. The acquisition of knowledge, from the increased means of enjoyment which it opens, is well worth a little exertion to attain. Do not allow the vast stores of knowledge, which are daily accumulating, to lie neglected, when, by acquiring a portion for yourselves, you may keep pace with those who are advancing in practical information, and, consequently, in respectability, influence, and worth, by their increased capabilities for conferring benefits upon their fellow men and themselves.

For the improvement of apprentices, and of those mechanics who have no other opportunity for obtaining such instruction, we have already succeeded in establishing evening classes, under competent masters; one for architectural and mechanical drawing, the other for instruction in those branches of arithmetic and geometry, that are not taught in the common schools. No young man who is ambitious to fit himself for excelling in his particular department, can fail to see the advantages which are thus held forth to him. Other classes are in progress of formation.

'The reading-room is open from two o'clock to five every day, and from seven to eleven o'clock in the evening. Many valuable periodicals, excluding those of a partisan or sectarian character, are liberally supplied. Do you think that a man, having spent the evening here in reading works of entertainment or instruction, will not feel better pleased with himself in the morning, than if he had spent the previous hours in dissipation?

For men with families, who prefer spending their leisure hours at their own firesides, the Lending-library supplies ample means of improvement and relaxation. Books of general literature, travels, fiction, history, and biography, in addition to the best writers on practical science, engineering, painting, building, dyeing, &c., and works of design, are lent out to the members generally.

Every member is free to all the lectures, and he likewise enjoys the privilege of bringing with him his wife or any female relative.

Lectures have, during the last year, been delivered on "Chemistry applied to the Arts and Manufactures," on "The Steam-engine," on "Natural Philosophy," &c., by Professor Kane, Surgeon Lover, and other gentlemen. It is intended that lectures will be repeated on these, or on such other subjects of a scientific and improving character as may appear advisable.

Every person paying annually or quarterly his subscription to the Institute, thereby becomes a member, and is entitled to all the privileges which have been already enumerated; and is eligible, after six months, to be chosen a member of the Board, one-half, at least, of whom must be operative mechanics.

Every person desirous of belonging to one of the classes, must pay half-a-crown per quarter in addition, for each class.

Can anyone assign a single good reason why every working man in Dublin should not become a member of the Mechanics' Institute?

(Signed on behalf of the Committee),

Zechariah Dowling,
Secretary."

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 244).

BISMUTH.—71.

THIS metal was known as early as 1520. It has a reddish-white colour, and a brilliant lustre. Its structure is crystalline, and it may be obtained in regular eight-sided crystals. Its specific gravity is about 10. It is brittle when cold, but may be hammered into plates when hot. It fuses at 476°.

Bismuth is readily oxidized and dissolved by nitric acid, forming a transparent and colourless solution, called the nitrate of bismuth; by pouring this into water, a delicate white powder is precipitated, which is a subnitrate. From its pearly whiteness, it is sometimes employed as a cosmetic for improving the complexion, and is sold by the perfumers under the name of pearl powder.

ANTIMONY.—65.

This metal was discovered by Basil Valentine, in the fifteenth century. It is a greyish-white brittle metal, having considerable lustre. Its specific gravity is 6.7. It melts at 810°, which is the temperature at which bodies become luminous in the dark. It is a crystalline metal, and may be obtained by slow cooling from a state of fusion, in regular eight or twelve-sided crystals.

Metallic antimony is known in commerce under the name of regulus of antimony, and is extensively used in the manufacture of printing types, which are made of an alloy of lead, antimony, and tin. The medium proportions used by type-founders in this city are, twenty parts by weight of lead, four of antimony, and one of tin. The same alloy is also employed in the stereotype plates, but it contains a larger proportion of lead. Antimony is also used in the block tin and Britannia ware.

There are three definite compounds of antimony and oxygen; the first is denominated the oxide of the metal, the second antimonious, and the third antimonic acid. The first unites with acids, forming salts. The sulphuret of antimony is the only ore from which the metal is obtained.

ARSENIC.—38.

This metal is generally found associated with others, and especially with cobalt and iron. The term arsenic, however, as generally used, denotes an oxide of this metal, while the metal itself is known in commerce under the name of cobalt, or metallic cobalt.

Obs. The application of the term cobalt to metallic arsenic, has probably arisen from the fact, that the ore which contains the latter is an ore of cobalt, and is reduced chiefly for obtaining zaffre and smalt, which are varieties of the oxide of that metal. On roasting such ores in a reverberatory furnace, the arsenic, from its volatility, is expelled, combines with oxygen as it rises, and condenses in thick cakes on the cooler parts of the chimney. The sublimed mass, after being removed and purified by a second sublimation, is the virulent poison known by the name of arsenic, white arsenic, white oxide of arsenic, and ratsbane. From this substance the metallic arsenic is obtained, by heating it with charcoal.

Arsenic is an exceedingly brittle metal, of a steel grey colour, crystalline structure, and has the specific gravity of 5.88. It is not easily fused, but when heated to 356° it rises in vapour, which has a strong odour of garlic. This property distinguishes arsenic from every other metal.

Chemists are acquainted with two compounds of arsenic and oxygen; both have acid properties, and are denominated arsenious and arsenic acid; the former consists of two atoms of metal, and three of oxygen; the latter of two of the metal, and five of oxygen.

Arsenious acid, as before stated, is the white arsenic of commerce, so frequently used as a poison, and is one of the products from roasting the ores of cobalt, and may be obtained by heating the metal in air. It is generally sold in the state of a fine white powder, but, when first sublimed, it is in the form of brittle masses, colourless, and almost as transparent as glass, but, by exposure to the atmosphere, the surface of the mass becomes opaque. It is said to have a weakly acrid taste, leaving a slight impression of sweetness. It changes vegetable blues to red. Arsenious acid generally forms a part of the ingredients of the plasters used by quacks for removing cancers. It is used for destroying troublesome animals, such as rats, and hence it is frequently called ratsbane. It is considerably used in glass-making, and for producing white enamel, and the white figures on porcelain.

Obs. The following method has been proposed by Brugnatelli for discovering arsenic and corrosive sublimate in their respective solutions, and to distinguish them from each other:—We must take the starch of wheat boiled in water, until it is of a proper consistence, and recently

prepared: to this is to be added a sufficient quantity of iodine, to make it of a blue colour; it is afterwards to be diluted with pure water, until it becomes of a beautiful azure. If to this azure-coloured solution of starch we add some drops of an aqueous solution of the oxide of arsenic, the colour changes to a reddish hue, and, finally, is quite dissipated. The solution of corrosive sublimate, poured into the ioduretted starch, produces in it almost the same change with the arsenic; but if, to the fluid discoloured by the oxide of arsenic, we add some drops of sulphuric acid, the original blue colour is restored with more than its original brilliancy; while the colour of the fluid that has been discharged by the corrosive sublimate, cannot be restored, either by the sulphuric acid, or by any other means.

Arsenic acid also combines with bases forming salts, called arseniates.

There are two combinations of sulphur with arsenic found in the mineral kingdom, and known by the names realgar and orpiment; orpiment has a bright lemon yellow colour, and was formerly much used as a pigment, both in oil and water colours, under the name of king's yellow. It is poisonous, though less so than the arsenious acid. Realgar, which is the protosulphuret, is composed of one atom of metal and one of sulphur, while orpiment is composed of one atom of metal and one and a half of sulphur, or, to express the same proportions in whole numbers, it may be considered as composed of two atoms of metal and three of sulphur.

COBALT.—29.

Cobalt is a brittle metal, of a reddish-grey colour, and feeble metallic lustre. It is attracted by the magnet; its specific gravity is, according to Turner, 7.83.

Cobalt, as before stated, is generally associated with arsenic, and frequently with iron. The mines which yield the ores are chiefly wrought for the oxide of cobalt, of which there are two varieties, known in commerce by the names of zaffre and smalt.

The ore is roasted in a reverberatory furnace, and most of the arsenic is expelled in the state of vapour, and an impure oxide of cobalt remains, called zaffre, in which state it constitutes an article of commerce. On heating this substance with a mixture of sand and potash, a beautiful blue-coloured glass is formed, which, when reduced to powder, is known by the name of smalt, and is sometimes called cobalt blue and azure.

Smalt, in the state of a very fine powder, is extensively used in the arts as a pigment.

Obs. 1. It forms the colouring matter of the blue earthenware; the figures are first printed from copper-plate engravings on silvered paper, and applied to the ware before the glazing is put on. The colouring matter of the print adheres to the ware by a little pressure; water is afterwards applied, which softens the paper so that it may be removed, and leave the coloured figure, which is afterwards covered with the transparent glazing.

Smalt is used to give a variegated blue in sign painting. It is also employed in paper staining. It is considerably employed by the manufacturers in finishing cloths, laces, linens, muslins, threads, &c., to impart a delicate blue, or to conceal some other tint. In France, it is extensively used by the laundresses, who mix it with starch, for the same purposes as above mentioned.

The oxide of cobalt is readily dissolved in acids. When the muriatic acid is used, a delicate sympathetic ink is formed, which is invisible when cold, but acquires a beautiful grass green when warmed.

Illust. 1. A good sympathetic ink may be formed, by heating one ounce of zaffre with four ounces of nitric acid for about two hours, keeping the liquid at the temperature of 212°, and then adding one ounce of common salt, and four ounces of water, and filtering the solution.

2. Paper fire-screens are sometimes adorned by drawings of trees, whose trunks and leafless branches are sketched in India ink (a winter scene), and the foliage is made with the invisible solution of cobalt; on bringing it near the fire, the green leaves at once appear, and spring returns.

NICKEL.—29.

Nickel is a white metal, whose colour is intermediate between that of silver and tin, and is both ductile and malleable. It has a strong metallic lustre, and is attracted by the magnet. Its specific gravity is between 8 and 9. It is less fusible than pure iron, and suffers no change by exposure, at common temperatures, to air, whether dry or moist.

Nearly all the nickel that is used, is obtained from the ores of cobalt, in the process for preparing zaffre and white arsenic, and is found in combination only with metallic arsenic, in a melted mass, in the bottom of the crucibles in which zaffre is prepared. This melted mass is called speiss, and it is from this that pure nickel is obtained. The chief use of nickel is in

the manufacture of the alloy called German silver, which is substituted for pure silver in the fabrication of various domestic articles.

CHROMIUM.—28.

This metal has a yellowish-white colour and a feeble lustre. It is brittle and infusible, and takes its name from the Greek word *kroma*, signifying colour; because its compounds constitute some of the finest mineral colours.

There are two compounds of chromium and oxygen. The first is an oxide of a dark-green colour, and is composed of 28 parts, or 1 equivalent of the metal, and 12, or 1½ of oxygen. The second combination forms an acid called chromic acid, and is composed of 28 parts, or 1 equivalent of the metal, and of 24, or 3 equivalents of oxygen.

Chromic acid is a crystalline compound, of a dark ruby-red colour, and unites with the oxides of metals and with ammonia, forming salts called chromates.

GEOMETRICAL QUESTION.

To the Editor of the Mechanic and Chemist.

SIR,—Although I am anxious at all times to be corrected when I *am* " mistaken," yet I cannot admit that I am mistaken in what I have written respecting my pedestrian question. I have submitted the question to friends, on whom I can rely, and they cannot conceive the possibility of a doubt as to my being correct. It is perfectly true, as stated in your notice to correspondents in No. 85, that L l, &c., are equal spaces, and P p, &c., are equal spaces; but it does not follow that $p\,l$, &c., are parallel to P L, nor will they all point to the north. I suspect, from the erroneous reasoning, that the writer of the notices to correspondents and " L. L.", are identical.

However, to put the matter beyond the doubt of a child, if you place yourself in one corner of a large room, and place your boy in another corner on the same side, and he move towards the corner opposite to you, do you mean to contend, that if you move continually towards the boy (who is always progressing and changing his place), you will move in a *straight line?* Or, which amounts to the same thing, can you for a moment contend, that if you walk direct from the corner in which you are placed, to the opposite corner, you will be continually moving towards the boy, although he is only travelling towards such last corner? Either of these positions is preposterous, and yet these are the positions which you and " L. L." contend for!

It might as well be said (and the cases are parallel), that because a planet is retained in its orbit by centripetal and centrifugal forces (each of which, taken alone, is a *rectilinear* force), it will not move in a curve, but in a straight line! This, we know, is not the case; and it is equally clear that the pedestrian must move in a *curve*, and *not* in a straight line.

Your and " L. L.'s" error consists in assuming a point where the two parties are to meet, from the rates of their travelling, and is, in fact, nothing more than an answer to the following question, scarcely fit for the consideration of a schoolboy of ten years of age:—" If A is distant from London eight miles, and B is distant from London $\sqrt{8^2+6^2}$ miles, and A travels four miles an hour, and B five, how long will they be before they reach London?" *Ans.* " Two hours." Of course, this is all that can be made of " L. L's" solution. The question to which he gives the answer is similar to the following:—" A and B are fifty miles asunder, directly east and west, and are each travelling in a straight line to a place directly north of B, so situated, that if B travels three miles an hour, and A four miles an hour, they will both reach it at the same time. How far distant is the place from A and B respectively?" But, in such a case, it can never be said, as in my question, that A is travelling towards B, for he is continually travelling direct to a place in advance of B, and to which B is also travelling. In fact, the matter is too clear to waste farther words about it. But, after all, I should like to see a correct and concise solution to my question. W. N.

[We repeat that " W. N." is utterly mistaken, and a correct and concise solution to his question has already been given. Our answers to correspondents are not, as he surmises, supplied by correspondents; and we know no more of " L. L.", than that he favoured us with an accurate, though somewhat too brief solution of the above problem. " W. N." appeals from our decision; he has a right to do so; and if he can persuade " L. L." and the rest of our mathematical readers, that two lines, near together, and each pointing to the north, are not to be considered as parallel, then, indeed, the question would assume a new aspect; but, unless this be conceded, P C is evidently a straight line. " W. N." appears to forget, that the light was to be continually due north of the traveller.—ED.]

THE CHEMIST.

ON ALKALIES.

(Continued from page 235.)

Brucia (Vegeto).—This alkali received its name from Mr. Bruce, the Abyssinian traveller, who first made known the tree, the false augustura, from the bark of which the alkaline substance is obtained. The bark is powdered and digested in ether, which frees it from oily matter; it is then treated with alcohol. This solution is then evaporated, which leaves impure brucia. To purify it, it must again be dissolved in water, and saturated with oxalic acid, then evaporated to dryness; the colouring matter is then removed by alcohol, and leaves pure oxalate of brucia, which is decomposed by lime; and the brucia may be taken up in a free state by boiling alcohol, from which it may be obtained by slow evaporation in the form of crystals. In this state it is a true hydrate, which, by fusion, loses a considerable quantity of water. Brucia is intensely bitter, is sparingly soluble in water, fuses at a temperature near 212° Fah., and, on cooling, looks like wax. Exposed to moist air, it swells, and becomes pulverulent. It combines with acids, forming neutral salts. Mr. Liebeg's analysis of brucia is as follows:—

Carbon........	70.88
Nitrogen......	5.07
Oxygen	17.39
Hydrogen	6.66
	100.00

Cinchonia (Vegeto).—To obtain this alkali, the alcoholic extract of the grey bark of cinchonia * is to be entirely dissolved in boiling water, strongly impregnated with hydrochloric acid; calcined magnesia is then added in excess, to fix the colouring matter; it is allowed to cool, filtered, and the magnesian precipitate washed with cold water. The precipitate having been dried on a stove, is to be repeatedly treated with alcohol, in order to dissolve all the bitter matter. The alcoholic liquors are now mixed, and the cinchonia crystallizes on cooling. It is white, and soluble in 700 parts of cold water. When dissolved in alcohol, and still more in an acid, its taste is very bitter. It unites with acids, forming salts, more or less soluble. When it is heated in a glass tube, it evolves ammonia. Some years back, MM. Pelletier and Dumas analyzed cinchonia, which afforded them

Carbon........	78.67
Hydrogen	7.06
Oxygen	5.16
Nitrogen	9.11
	100.00

Codeia (Vegeto) was discovered by Robiquet in 1832. In treating a solution of opium with muriate of lime, muriate of morphia is precipitated in combination with another substance, which is codeia. From this precipitate the latter is separated by ammonia; the major part of the morphia is precipitated. The supernatant solution of codeia, with some non-precipitated morphia, is concentrated, until the chlorohydrate of ammonia begins to crystallize, and with it the double salt of morphia and codeia. The crysta's are to be dissolved in water, and filtered through animal charcoal; a slight excess of caustic potassia is then added, by which means the codeia alone is precipitated. It is then taken up by alcohol or ether, which yields it pure by evaporation. Codeia is insoluble in alkaline solutions; it combines with acids, forming neutral salts, which are decomposed by tannin. According to M. Robiquet, it is composed of

Carbon	71.339
Nitrogen......	5.353
Hydrogen	7.585
Oxygen	15.723
	100.000

G. W. S. Piesse.

IMPROVED CHEMIST'S MORTAR.

To the Editor of the Mechanic and Chemist.

Sir,—It is well known, that in pulverizing drugs, a considerable portion is lost, besides the offensive odour that arises, from some—aloes, for instance. I think the following simple plan would effectually remedy the evil:—Take a piece of fine cloth, make it in the form of a bag, but open at both ends; one end should be made wide enough to slip over the top of the iron mortar, round which should be fastened a thin band of India-rubber, rather smaller than the top of the mortar, so as to slip over it; the other end of the bag should have a small ring of the rubber fastened to it, so as to slip over the pestle; so that when one end is slipped over the top of the mortar, and the other over the pestle, not a particle of the powder can escape; and it does not in the least prevent

* Peruvian bark.

the action of the pestle, or cause a loss of time, as it can be taken off in a moment. I have made one myself, and have used it for several years, and the expense is only trifling.

I remain yours, &c.,

J. Thomson.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 15, W. Rider, Esq., on Engraving. Friday, April 17, Institution closed. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, April 15, Quarterly General Meeting. At eight o'clock.

Poplar Institution, East India Road.—Tuesday, April 14, T. Archer, Esq., on Igneous Geology. At eight o'clock precisely.

QUERIES.

1. What composition is that which will change any coloured hair a jet black? 2. What will make the hair curl? 3 How to make the white shaving soap, such as is commonly sold in the shops? A. H. D.

Coventry.

[The first question has been so often asked and answered in the "Mechanic," that we are compelled to decline saying anything more about it; we, nevertheless, leave it open for any of our correspondents who can describe a method superior to the nitrate of silver. We do not think that "a hair-dresser" would be benefitted by speculating in soap-boiliug; but he might find some advantage in adding a little sweet oil to lather; this is, in the language of old writers of receipts, "proved."—Ed.]

How to make the writing-fluid, that, at the time of using, is of a greenish blue, but soon turns a deep black? J. M. H.

How to stain white whalebone blue or green? J. H.

How to make yeast different from that which is procured at the brewers? W. T.

How to obtain fluoric acid? T. West.

Can any of your correspondents inform me what to put with glass to make it melt easier?—(Borax.) How to make bird-lime? What to put in bread seals to prevent their cracking? I have found putting them in a cold place does not effect the object. W. V—e.

The best method of staining leather, or, at least, the ingredients I should use, to produce a sky blue and a grass green? A. Z.

ANSWERS TO QUERIES.

To make Blue Ink.—Prussian blue, ¼ oz.; oxalic acid, ½ oz.; water, 16 oz.. The above keeps its colour, and is not affected by acids, though, of course, it will not stand a strong alkali. J. M. H.

"V. Knox." "1. Why is the apparent brightness of a star increased by the use of a telescope, while that of a planet is not?" This, I conceive, arises from the fact of the planet, when viewed through a telescope, being magnified in *size*, while a star is only magnified in *lustre;* it not appearing through a telescope to be increased in size, but to still remain a mere point.

[The intensity of the light emitted by a star, is estimated at about 300,000 times greater than that of a planet. If a star does not appear to the naked eye so bright as when magnified by a teleseope, it is because our organs of vision cannot appreciate the impression of so extremely small an image.—Ed.]

"2. Why are some stars visible only at particular seasons of the year?" Because, by the apparent motion of the sun in the ecliptic, all stars (except those circumpolar stars, which are always above the horizon) rise and set nearly four minutes earlier every day. Therefore those stars (except as above mentioned) which are now visible in the night, will, in six months hence, be above the horizon in the day time, and will, consequently, be then invisible, because of the sun's light, and *vice versa*.

"3. How the *apparent* place of a star, at any time, is calculated from its mean place at the beginning of the year?" A full answer to this would occupy too much space. In the first place, we must find the *mean* place at the given time by the annual variations in right ascension and declination. To this the proper corrections must be made for precession, aberration, and nutation, and we shall have the *true* place of the star. The altitude of the star for the given time and place may then be found, and that increased by the refraction in altitude, will be the star's *apparent* place. The correction for refraction, however, is not necessary in occultations and near approaches of a star to the moon, &c., as both sides are then affected by it equally. "V. Knox" will find the necessary tables for the above corrections, in "Galbraith's Mathematical and Astronomical Tables," which is a very useful work.

W. N.

"S. C." "There was an occultation of the star α Leonis by the moon; the time for Greenwich was 7 h. 10 m. immersion, and 8 h. 21 m. emersion; would there be any difference, and what the difference, between the time at Greenwich, and in 50° 36′ north latitude, and 2° 27′ west longitude?" It is impossible, from the question *as stated*, to give a *correct* answer. In consequence of the large parallax of the moon, her *apparent* places, as seen in different latitudes and longitudes at any given moment, will always be different. The only *correct* way of solving "S. C's" question is, to compute the times of the immersion and emersion for the given place; which is a work occupying considerable time and space. (See any work on practical astronomy or spherical trigonometry, or Galbraith's book above referred to) The difference in actual time asked by your correspondent is trifling; but, as the motion of the moon in the zodiac is

from west to east, the more westerly the place, the earlier the occultation takes places. However, your correspondent must recollect, that to obtain the time on his meridian, it is necessary to subtract from the Greenwich time, 9 m. 48 s., answering to the difference of longitudes. That is, that the occultation, as observed at Greenwich, commences at 7 h. 0 m. 12 s. Weymouth time, and ends at 8 h. 11 m. 12 s. Weymouth time. Being an amateur astronomer myself, I shall be happy at any time either to give (so far as is in my power) or to receive any information or assistance in astronomy, either through this work, or by letter in a private way.

W. N.

To Stuff Birds.—The principal beauty of stuffed birds, consists in their being well shot; for the large species, ball-shot from a rifle should be used, and, for smaller ones, dust-shot. As soon as one is killed, a little wool should be laid upon the bleeding orifice, the feathers laid in order, and the head wrapped up in tow; it should then be packed in hay, and then quickly conveyed home. You then lay it upon a clean cloth, and part the feathers of the breast and abdomen; then divide the skin, taking care not to soil the feathers from the breast to the rent; or they may be opened under the wing: and those who have beautiful breasts, as the divers, &c., may be opened on the back. Separate the skin from the muscles and cellular tissue, by means of the finger or a blunt instrument. Push up the thighs, and deprive them from the flesh, and break the bone about its middle; draw the skin over the body, and remove it also from the wings to the second joint; treat them as you have done the thighs; then turn the skin over the head, and remove the occipital part of the skull, so that you may be able to scoop and wash out the brain. Remove the eyes, dissect away as much flesh as possible from the skull, and. when you have finished shining it, rub the skin over with chalk, to remove adipose matter; wash it clean with a sponge and warm water, then cover it all over with either the following solution, powder, or soap:—

Solution.—Muriate of mercury, 1 oz.; alcohol, 8 oz.

Powder.—Muriate of mercury, ½ oz.; burnt alum, ½ oz.; tanner's bark, 3 lb.; camphor, 4 oz.

Soap.—Camphor, 5 oz.; arsenious acid, 2 lb.; white soap, 2 lb.; subcarbonate of potass, 12 oz.; powdered lime, 4 oz.

To keep the Hands from Chapping.—Tincture of Peruvian balsam, 2 oz.; tincture of benzoin, 1 oz.; tincture of aloes, 1 oz.; hydrochloric acid, 10 drops.

MANIPULATOR.

The title of the work to which "R. H. S." alludes, is "The Cabinet-maker's Guide," in which he will find the information he requires. There are two works under this title; the first of which was published anonymously, and printed by or for Knight and Lacy, Paternoster Row; the second, which is little more than a reprint of the other, except the article on upholstery, is edited by J. Stokes, and published by Dean and Munday, Threadneedle Street; however, I think the first will suit the purpose of "R. H. S." the best.

B. T.

TO CORRESPONDENTS.

THE PENNY POSTAGE.—*Complaints having reached us of the difficulty of procuring our work in some of the country villages and other places, our correspondents are reminded, that the* "MECHANIC AND CHEMIST" *is forwarded through the post two days prior to the date of publication, upon the following terms; viz.:—*

Subscription for one year (including postage and supplementary Nos., to be paid in advance)	*Half-a-Sovereign*
Half-year	*A Crown*
Quarter of a year	*Half-a Crown.*

All letters to be prepaid, and addressed to D. A. DOUDNEY, *City Press*, 1, *Long Lane, Aldersgate Street.*

Slammann, Hamburgh.—*Has addressed to us a number of queries concerning certain reservoirs of water, but has omitted to explain what and where they are.*

I. Q. G. *in our next.*

F. M.—*Once more, the oxide of iron is the substance used for razor-straps, and as it may be obtained of various qualities, more or less mordant, it is well adapted to various similar purposes.*

B. Tongue.—*M. Daguerre announced some time ago, that he had succeeded in substituting silvered copper for the plated metal originally employed. We believe it is customary for country post-offices, to charge a halfpenny, for the conveyance of prepaid letters to isolated houses; but all such questions will probably be settled, when the measure is brought finally before the House at the end of the present sessions.*

Junius.—*Proposition* 1 *is correct; the 2nd. and 3rd. are untrue.*

I. C.—*The various nostrums, which are sold to make hair grow on bald places, are of no utility whatever, except to the sellers. It is generally supposed that uneasiness of mind is unfavourable to the preservation of the hair. The following recipe may be serviceable in some cases: take a pint of the finest old port, and, after dinner, slightly moisten the part therewith, and drink the remainder. If about half-a-dozen patients afflicted with the same complaint, assemble together daily, and persevere in the proposed remedy, they will soon experience and proclaim its efficacy.*

W. T's. *receipt is incorrect, and might, if through any oversight it had gone to press, have caused a great deal of mischief.*

S. S.—*If he will enclose the model, and write upon it* "*confidential*" *it will only be examined by one person.*

ERRATUM.—Page 258, for "$p p''$," read $p' p''$.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

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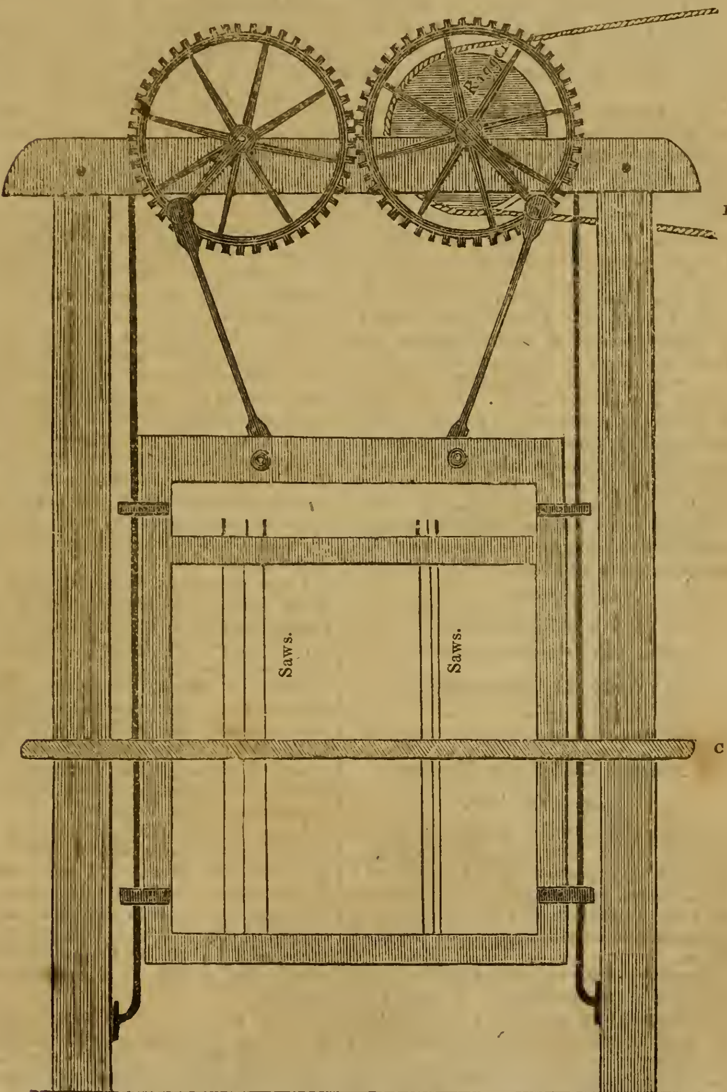
VERTICAL SAW FRAME.



City Press, 1, Long Lane, Aldersgate Street D. A. Doudney.

VERTICAL SAW FRAME.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Never having seen in the "Mechanic and Chemist" any plan of a vertical saw frame, similar to the one annexed, I send you a plan of one of my construction; and would feel greatly obliged if you could inform me whether anything in this form has ever before been set in motion. My object is, to reduce the friction in the slides, which, in the common way, is very great, being generally worked by one crank.

You will perceive from the sketch, that the geared wheels revolve in reverse directions, and the upper cranks, which are firmly fixed to the axles of both wheels, elevate and depress the saw frame, without any material friction in the slides, working, as it does, in a true vertical line. B, the drawing-strap or cord; C, the bench; the scale, one inch to the foot. The one I am fitting up is on a small scale, having only a twelve-inch stroke. I have intended it to be fixed at the head of one of my carpenter's benches, for the purpose of sawing tenons, &c., in cabinet and joiners' work. If you think it worth your notice, by inserting it in the pages of your valuable work, called the "Mechanic and Chemist," I shall feel much obliged. Perhaps some of your numerous correspondents may wish to know more on the subject; if so, I shall be most happy to explain its working parts more minutely.

ON THE METALS.

(From Hope's "Practical Chemist.")

(Continued from page 291).

THE MORE PERFECT USEFUL METALS.

Mercury, Gold, Silver, Platinum.

MERCURY.—200.

This metal is more commonly called quicksilver, a term given by the alchymists, who supposed it to be silver in a liquid state, rendered so by the presence of some substance, which they hoped to separate and obtain the silver in the solid form.

Mercury is the only metal that is liquid at common temperatures. It freezes at the temperature of 70° or 72° below that of freezing water, when it is malleable, and may be cut with a knife. At ordinary temperatures, its specific gravity is 13.54, but, when frozen, it is 15.61. Heated to 662°, it boils, and condenses again into a liquid on cooling. It is not oxidized by exposure to air at common temperatures.

The only acids that readily act on mercury, are the nitric and sulphuric; the former at common temperatures, and the latter only by application of heat.

Mercury is occasionally found in the native state, but more frequently in combination with sulphur, forming the compound known by the name cinnabar, which is the chief ore of that metal, and is reduced to the metallic state, by heating it with lime or iron filings, by which means the mercury is volatilized, and the sulphur retained in combination with the lime or iron.

Mercury is extensively used in the arts. Immense quantities are employed in the gold and silver mines, for the reduction of those metals. It is the chief liquid employed in barometers and thermometers. In combination with tin, it forms the amalgam used in covering the backs of looking-glasses.

Illust. This process is performed by pouring quicksilver on the glass in quantities sufficient to cover it, and then carefully placing over it a clean sheet of tinfoil, pressing it close to the glass, so as to force out the fluid quicksilver; a part of it, in the mean time, from its affinity with the tin, will have combined with it, forming an amalgam, which, after being pressed for twenty-four hours, to force out any remaining fluid quicksilver, adheres firmly to the glass.

Large quantities of mercury are used in the process called water-gilding. It is largely employed in the preparation of vermilion, red precipitate, calomel, corrosive sublimate, &c.

Obs. The quicksilver mines of Idria, situated in the southern part of Austria, yield annually 356,000 lbs. of quicksilver, 67,000 lbs. of vermilion, 1,600 lbs. of calomel, 700 lbs. of red precipitate, and 600 lbs. of corrosive sublimate, besides 19,000 lbs. of lump cinnabar.

There are two oxides of mercury; the protoxide is a black powder, and is composed of 200 parts, or 1 equivalent of mercury, and 8, or 1 equivalent of oxygen. The peroxide exists in shining crystalline scales, of a bright-red colour, and is composed of 200 parts, or 1 equivalent of the metal, and of 16, or 2 equivalents of oxygen.

There are two chlorides of mercury, which are extensively used in medicine. The protochloride, called calomel, and the bichloride, called corrosive sublimate. The latter is exceedingly poisonous when

taken internally, and is frequently used for destroying troublesome insects.

Corrosive sublimate is prepared by subliming a mixture of common salt, and bisulphate of mercury: the chlorine of the salt goes to the mercury, and the sulphuric acid of the mercury goes to the soda. Thus we have, as products, bichloride of mercury and sulphate of soda.

Calomel is prepared by subliming a mixture composed of equal weights of corrosive sublimate aud pure mercury. The corrosive sublimate, which is bichloride, gives up one-half of its chloriuc to the mercury, and the whole becomes a protochloride or calomel.

Obs. Calomel occasionally contains a little corrosive sublimate, which may be detected in the following manner:—Agitate the calomel with hot water, which has no action on the calomel, but if corrosive sublimate be present, it will be dissolved; now pour off the water into a wine-glass, and add a few drops of lime-water; if corrosive sublimate be present, an orange-coloured powder will be precipitated.

Bichloride is composed of 200 parts, or 1 equivalent of mercury, and 72, or 2 equivalents of chlorine, while the protochloride contains 1 equivaleut of each element.

There are two compounds of sulphur, and mercury. The protosulphuret is black, and the bisulphuret is red. The latter is formed by subliming a mixture of mercury and sulphur. The sublimed mass, when reduced to a powder, is the beautiful pigment vermilion.

Cyauogen combines with mercury, forming a crystalline compound, called the cyanide or cyanuret of mercury. This compound was formerly supposed to consist of prussic acid and oxide of mercury, and was called prussiate of mercury. It is composed of 52 parts, or 2 equivalents of cyanogen, and 200, or 1 equivalent of mercury; it is, therefore, a bicyanide. By heating this compound, it is decomposed, yielding cyanogen and metallic mercury. This constitutes the process described by chemists for obtaiuing cyanogen.

SILVER.—108.

Silver is frequently found in the native state, and also in combination with other metals and with sulphur. In the state of sulphuret, it is almost always contained in the lead ores; hence the lead of commerce generally contains a little silver.

The colour and lustre of this metal, from its use as a coin, are more familiarly known than most other metals. It is not oxidized by exposure to air and moisture at common temperatures. It is malleable and ductile, and, when pure, is so soft, as to be easily cut with a knife. Its specific gravity, when hammered, is 10.51. It melts at a full red heat.

Silver is extensively used in the arts for mauufacturing various domestic articles, and is alloyed with about one-twelfth its weight of copper. The silver coin of the United States contaius about one-ninth its weight of copper. It is exteusively employed for plating on copper, and used in manufacturing plate ware.

Illust. 1. The English plate, much of which is manufactured at Birmingham, and hence is called Birmingham plate, is formed by soldering to a thick bar of copper, another of silver one-twelfth of the thickness. The compound bar is then passed between heavy iron rollers, and rolled out, so that the plating of silver over the copper, is said, in some cases, to be only one-thirty thousandth of an inch in thickness. The silver plate, as thus prepared, is used for manufacturing the silver bands on carriage-wheels, candlesticks, tea-pots, and various other articles.

2. The French plate is formed by covering the clean surface of the copper with silver leaf, which is burnished down with steel burnishers.

3. Thermometer and barometer scales are silvered, by first rendering the scales perfectly clean, and in that state rubbing them with a mixture of two parts of cream of tartar, two of common salt, half a part of alum, and half a part of silver in fine powder.

Silver is readily acted upon by nitric acid, which first oxidizes the metal, and then dissolves it, forming a nitrate, commonly called lunar caustic; lunar, from the ancient name of the metal, and caustic, from its rapid destruction of the skin and flesh wherever it is applied. This is frequently used by surgeons, and is prepared by fusing the nitrate and casting it in moulds, forming it into sticks about the size of a common quill.

ON ELECTRICITY.

NO. II.

(Continued from page 267.)

When about to prosecute a course of experiments, the machine should be brought out and placed at a short distance from a good fire, in order to render it thoroughly warm and dry; for it is a fact which cannot be repeated too often to the

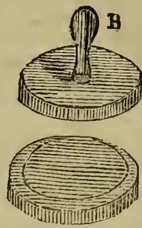
young beginner, that, unless the whole of the apparatus be in this condition, he will often be disappointed in the results of his experiments. Particles of moisture attaching themselves to the glass pillars, tend, in a great degree, to destroy their insulating properties, and, even when suspended in the air, tend powerfully to carry off electricity. When the glass is sufficiently warmed, the cushion is to be removed, and a thin coating of amalgam evenly spread over the whole surface, which tends greatly to increase the excitation; it should then be returned to its place, and the cylinder set in motion, which should always be in the direction of the silk flap. After a few turns, the cushion is again to be removed, and amalgam applied to any defective part. All that is above the line, where the silk flap joins the cushion, is to be separated from it; the silk flap. wiped clean, and the rubber returned to its place. Lastly, the whole of the apparatus is to be rubbed over with a warm silk handkerchief, and the machine may then be placed upon the table, ready for use.

While in this condition a copious flow of electric fluid will always be obtained; and, if the machine could be kept at the same temperature, the supply would not be diminished during a whole course of experiments; if not, the cylinder will soon cool, dust will accumulate on the machine, and render every exertion fruitless. This may be in some measure remedied, by having a warm silk handkerchief, or woollen cloth, in readiness, and well wiping, from time to time, the cylinder, conductor, and pillars; but a better method is, to place on the base of the machine, directly under the cylinder, a small box of sheet iron, supported on a proper stand, about six inches in length, three in breadth, and one in depth, having a lid to raise easily, into which is placed a piece of bar iron, of nearly the same proportions, heated to redness. This will diffuse as much heat as will be required; and, if another piece of iron of the same size be kept in the fire, to take the place of the other as it cools, a temperature will be maintained sufficient to keep the machine in good action.

The best amalgam for electrical purposes, is made by melting one ounce of tin and two ounces of zinc together, and in this state mixing them with six ounces of mercury previously heated, and then agitating the mixture in a mortar or iron box till cold. It is then to be reduced to a fine powder, and mixed with fresh lard, to the consistence of thick paste. Some recommend this not to be done till the amalgam is about to be used; but I have found, when this is the case, it is apt to make the cylinder greasy, and prevent a copious flow of electricity; it is, therefore, better to be done a few days previously.

THE ELECTROPHORUS.

Fig. 3.



This is a very simple instrument, and one which might almost be termed a small electrical machine; and as we have just been speaking of the apparatus required for obtaining electricity, we shall here briefly describe it, postponing, till a future Number, the laws by which it is governed.

It consists of two conductors, each about six inches in diameter, and half an inch in thickness, and an electric. The upper one, *a*, may be made either of a plate of metal or wood, covered with tin-foil, well rounded at the edges, to prevent the escape of the electricity; it is furnished with a glass handle, B, by which it is raised. The lower plate, *a*, is similarly constructed, and is surrounded with a tin hoop, rising half an inch above its upper surface, for the purpose of containing the electric, which is composed of one pound of resin, three-quarters of a pound of shell lac, and half a pound of Venice turpentine, melted together, and poured within the hoop of the lower conductor, till it rises to the surface, and then suffered to congeal. When the instrument is about to be used, the surface of the electric is to be rubbed with a dry woollen cloth, and it will be excited negatively*; place the upper conductor upon it by means of the glass handles, and touch it with the finger, when it will be positively electrified, and if brought in contact with a conducting body, produce a spark. This may be done repeatedly, without the excitation being renewed, and small jars charged, as from the conductor of the electrical machine.

H. WIGLESWORTH.

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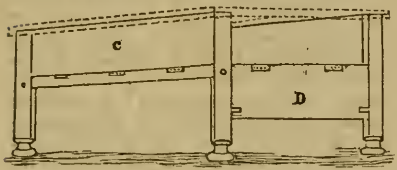
* These terms will be explained in a future Number.

TABLE BEDSTEAD.

To the Editor of the Mechanic and Chemist.

Sir,—The accompanying is a sketch of a bedstead and table combined, which I have lately constructed for my library. The side flaps shut into the four posts, and a large flap or table-top (dotted in the sketch), fits on by a groove, forming, in the day-time, a table, and at night a bedstead.



A common French, or tent bedstead, can be altered to my plan. The flap, D, is shown open, and C shut.

I remain yours, &c.,

D. B.

REVIEW.

History and Guide for Drawing the Acanthus, and other Description of Ornamental Foliage. By I. Page. London: I. Page, Atlas Press; Berger, Holywell Street, Strand.

There is no art more generally applicable to the numerous branches of manufacture, than that of design; and yet it has been inconceivably neglected, both by teachers and writers for the working classes. A knowledge of the benefits which foreign countries have derived from an early and careful cultivation of this art, has at last directed the attention of Englishmen to the subject, and the most satisfactory results may be anticipated from the various popular schools of design, which are now established.

The volume before us contains a variety of engravings which will, no doubt, materially assist the student in ornamental drawing. The author is a practical man, and a master of drawing, and he claims the singular merit of writing and printing the book, and designing and engraving the numerous plates and wood-cuts. It may be regretted by some, that a better understanding does not exist between our author and Lindley Murray; but it should be recollected, that works of this kind are not intended as specimens of literary excellence, but merely as vehicles for the conveyance of useful information, to assist and direct the operations of practical men. We select the following passage as a specimen:—

"You learn more in two hours from a good lecture on any subject, when practically explained, than you would in a fortnight's labour; and why? the lectures of a profound scientific man open volumes before you; he has struggled, studied, attended institutions, and gone through the most difficult hardships and problems to arrive at an apex of perfection, and perhaps, in some instances, he has given two or three years' study and attention to one subject, and would willingly come and put you in the full possession of all in the same number of hours. How many are there at the present time, who are in duty bound to be thankful to Mr. Hayden, Dr. Birkbeck, and many others of lesser talent, for the knowledge they have arrived at? yet so trifling and easy a road for each description of studies they might wish to follow; and sincerely hope, in my department and description of the arts so to simplify it, on the true basis and principle, that you may derive the same benefits from my information, as others have done from much more scientific men, and whose affluent circumstances have placed it in their power to travel and study, when I could not; but trusting I have collected and seen sufficient, at least, not to misguide you, and to this end, the following paragraph is very appropriate, and, at the same time, I think no harm in noticing it, particularly when it is obtained from such an author:—

'From small beginnings, great conditions rise;
Act well your part; there all the honour lies.'"

THE CHEMIST.

CHEMICAL ANALYSIS.

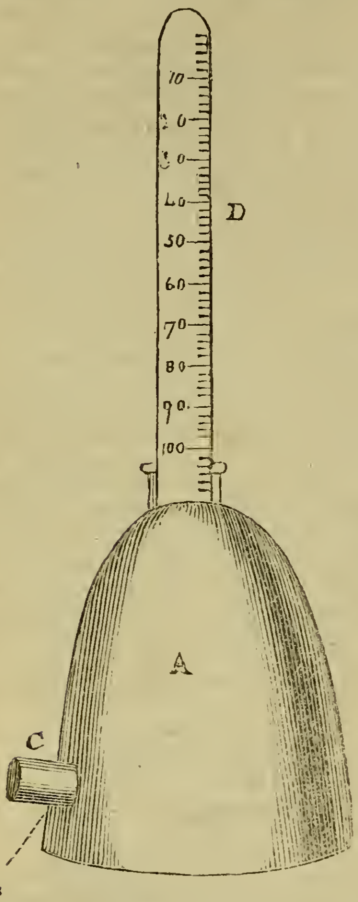
(Continued from page 258.)

Agreeably with my proposal in No. 83, I shall now briefly describe the usual manner of

Analysing and Determining the Quantity of Carbonic Acid in Gaseous Mixtures.—To know whether any mixture contains carbonic acid, may be readily ascertained by shaking it up in a bottle, containing a small quantity of lime or barytic water, when turbidity will readily appear; carbonate of lime or baryta being formed.

To determine the quantity of carbonic acid, an instrument is generally employed, known by the name of Hope's endiometer. It may be very easily constructed:—A bottle is first to be obtained, similar in

shape to A in the engraving; a hole must be drilled in the side, B, and a cork made accurately to fit, C, or a stop-cock inserted; a tube, D, of the capacity of one cubic



inch, is to be divided into 100 equal parts, and inserted into the neck of the bottle, where it is to be firmly secured. When required for use, the bottle is to be filled with lime-water, and the tube with the gas for examination; which may be done through the agency of the pneumatic trough. The contents of both bottle and tube are then to be briskly agitated; you then withdraw the cork, C, under water, when the liquid rushes into the tube, supplying the place of the gas, which has been absorbed by the lime-water, and which has formed carbonate of lime. Repeat the process as long as any absorption ensues. When the quantity of gas absorbed denotes the quantity of carbonic acid originally contained in the mixture.

MANIPULATOR.

(*To be continued.*)

LAUGHING GAS.

To the Editor of the Mechanic and Chemist.

SIR,—I think a much easier plan of producing the exhilrating effects of the nitrous oxide of Davy, is produced by sulphuric ether. The ether is to be introduced into a bag, and applied in the same manner as the protoxide of nitrogen. I have practised it upon myself, and find it answers exceedingly well; except that the ether produces a rather disagreeable taste in the mouth.

I remain yours, &c.,
MANIPULATOR.

ELECTRICAL EXPERIMENTS.

To the Editor of the Mechanic and Chemist.

SIR,—The few following experiments may, perhaps, be novel to some of your readers who are engaged with electricity.

Experiment 1.—Sprinkle a little powdered resin on the table of the universal discharger; when a strong charge is passed through the resin, it is suddenly inflamed, producing a flash similar to gunpowder; a black smoke, at the same time, curling up from it. The above effect will, of course, not be produced, unless the table of the discharger be covered with glass or some other non-conducting substance.

Exp. 2.—Pass a middling charge through a piece of moistened sponge; it is rendered luminous for a few seconds, giving out a beautiful rose-coloured light.

Exp. 3.—The influence of the electric fluid on the taste of several fruits, is well worth noticing, a good example of which is a raisin: after having been exposed to a single spark from a jar, it acquires a taste similar to one that has been smoked; that flavour is, of course, increased, if the raisin be exposed to a series of sparks.

Exp. 4.—Allow the charge of a jar or battery to pass over the surface of a cabbage leaf; the course of the electric fluid is marked by a shining appearance of that part of the leaf exposed to its action. If the leaf be kept for a day or two, the track of the fluid is observed from the part having turned quite brittle, and bearing a withered appearance.

A YOUNG EXPERIMENTALIST.

CHEMICAL AND PHILOSOPHICAL SOCIETY

FOR SHOREDITCH AND THE NEIGHBOURHOOD.

To the Editor of the Mechanic and Chemist.

SIR,—The provisional Committee of the above Society beg to state, through the medium of your Journal, that the arrangements for its opening are proceeding rapidly. Persons who wish to become members, are requested to forward their addresses either to Mr. Jeffs, 81, Shoreditch, or to me; and tickets for the introductory lecture will be duly forwarded to each. After the lecture, the quarterly tickets can be received.

H. WIGLESWORTH, Sec.

65, Tooley Street, Southwark.

SOLUTION OF PROBLEM.

Given $x^2+1+\frac{x\sqrt{x}+\sqrt{x}}{2}=\frac{11x}{2}$;

Or, $2x^2+2+(x+1)\sqrt{x}=11x$. By transposition and division,

$\sqrt{x}=\frac{-2x^2+11x-2}{x+1}$; and, by squaring both sides,

$x=\frac{4x^4-44x^3+129x^2-44x+4}{x^2+2x+1}$; or,

$4x^4-45x^3+127x^2-45x=-4$. Let $x=\frac{y}{4}$; then we shall have

$y^4-45y^3+508y^2-720y=-256$, where all the roots are positive.

And by trying the positive divisions of the last term, we shall find that 1 and 16 are two of them that produce an equality; therefore, they are two of the roots of the equation. Now, let the equation last found be divided by

$y^2-17y+16(=\overline{y-16}\times\overline{y-1})$, and we get the quadratic equation

$y^2-28y+16=0$; whose roots are $14\pm\sqrt{180}=14\pm2\sqrt{45}$.

Therefore, the four values of x are 4, $\frac{1}{4}$, and $\frac{7}{2}\pm\frac{1}{2}\sqrt{45}$. L. L.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 22, Dr. Epps, on Phrenology. Friday, April 24, Charles Wood, jun., Esq., on Spain. At half-past eight precisely.

Poplar Institution, East India Road. Tuesday, April 21, J. Robinson, Esq., on Botany. At eight o'clock precisely.

QUERIES.

Light is stated to travel at the amazing velocity of 192,000 miles in a second of time; how is that ascertained? P. A.

How is it, that, on the equilibrium theory, in north latitude, the day tides are higher than the night tides during summer, and lower during winter? P. AMER.

I am about completing a model of a railway engine, but I am rather at a stand, being in want of the following information:—1. Not knowing exactly the shape of the boilers commonly used for models. 2. The exact place for the lamp. 3. From what part of the boiler is the feeding-pipe brought for working the cylinders?

A. T.

A receipt for the composition of stereotype plates? Also, what the moulds are made of, that they are cast in? Also, the method of making the inking rollers?

EXPERIMENTAL MECHANIC.

1. The best means of obtaining the vanishing points of perspective drawings, so as to make a perfect perspective view? 2. How to paint water-colours on satin? 3. The best substitute for glass to hold the conductor of an electrifying machine; wax will do, only that it so often breaks? 4. How to erase amalgam from gold or silver; as I find the more you rub it, the worse it is? 5. The best composition for making moulds for frames, &c.? J. RICHARDSON.

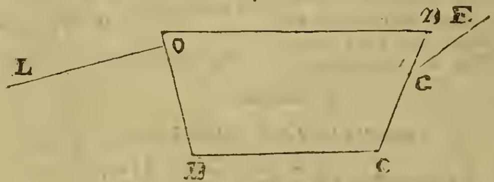
A method of cleaning kid gloves? Spirits of turpentine with spirits of wine, will answer as far as cleaning goes, but the smell is disagreeable, unless the turpentine can have the smell destroyed without destroying the cleansing properties?

P. C.

How the leads for ever-pointed pencils are made? Where can I get the best glasses for a

telescope, and about the expense of these focuses: $1\frac{7}{8}$ inch 3 ft, plano-convex; $2\frac{1}{2}$ inch, ditto; 2 inch, ditto; $1\frac{1}{2}$ inch, ditto?

Given any trapezium, A B C D, and if a force $=$ to 16 pounds be applied to the line L O, it will require a force $=$ to 34 pounds to move it about the point C, it being applied to the line E G. Now the force applied to the line L O, is $= 30$ pounds; the angle L O D, is a right one, and the distance, D O $= 37$; then what force must be applied to the line E G, to keep the two forces in equilibrium, when the angle B G E $= 30^0$, and the distance, G C $= 25$? L. L.



Is there any rule by which I can curve a spring, which is of equal breadth and equal thickness throughout its length, in such a manner, that when the ends are pressed down, and it is brought into a straight line, it shall press equally

upon the board in every point between the ends? When I bend it to the segment of a circle, the greatest pressure is in two points half way from the centre to each end. Thus, at points 1, 2, is the greatest pressure when the spring is brought down. T. Z.

The best method in use for dissolving India-rubber, and the method of applying it? Likewise any composition of a similar elastic and water-proof nature, that will answer the same purpose as India rubber, but be prepared at a much cheaper rate? H. J.

How to regild picture frames? G. W.

TO CORRESPONDENTS.

J. A. T.—*We shall be glad to see the description of his model.*

John Potter, Wigan.—*The residence of Dr. Turnbull is in Russel Square, London. From our correspondent's account of his case, we entertain little doubt that, inveterate as it is, it will not resist the skilful management of the doctor; but, of course, he alone can speak with certainty. We are doing no more than justice, when we state on the best authority, viz., actual observation, a fact highly honourable to that gentleman's character, that every applicant, rich or poor, is received with equal kindness and attention.*

P. T. *will shortly find ample information on the subject of his inquiry, in an article which is now in preparation.*

Curioso.—*Diamonds are considered to be pure carbon; they may be dissolved, or, rather, dispersed by heat, and nothing whatever has been detected besides the carbon.*

L. L.—*We prefer the answers being sent with the questions, when they are intended only to elucidate points of mathematical science. Letter-balances constructed similarly to those used for weighing gold coin, are now in use; but in all cases it is necessary that the scale which contains the letter, should be suspended.*

G. W.—*Glass is dissolved by fluoric acid. It may be obtained at the chemists' shops in lead bottles.*

H. M.—*An hydraulic lamp, invented by MM. Gerard, brothers at Paris, was first published in this country in the "Mechanic and Chemist," Vol. III., No. 119, Dec. 15, 1838. The principle of this lamp is exactly the same as that of the fountain to which he refers, described in the "Saturday Magazine" for May, 1839. In the application of this most admirable invention to the production of a jet d'eau, a syringe or pump must be introduced, to bring the water back from the lower into the upper reservoir, as often as it becomes exhausted. The height of the upper surface above the lower one, should not be less than five or six feet, to produce a jet of sufficient force for a garden fountain.*

A. J. P.—*It is not in our power to forward the views of our correspondent. We should recommend him to apply at the offices of any of the railway companies now in operation.*

G. W.—*The method of using French polish shall be described in our next.*

W. W.'s *shorthand will appear as soon as the plate is ready.*

A Subscriber.—*Rancid oil, which, by its acidity, is injurious to fine machinery, may be purified by heating it with calcined magnesia. Animal oil is found to be preferable to vegetable. We refer our correspondent to No. 52, Vol. II., of the "Mechanic," for farther information.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 89, NEW SERIES. | SATURDAY, APRIL 25, 1840. PRICE ONE PENNY. | No. 210, OLD SERIES.

THE PATENT OMNIBUS.

Fig. 1.

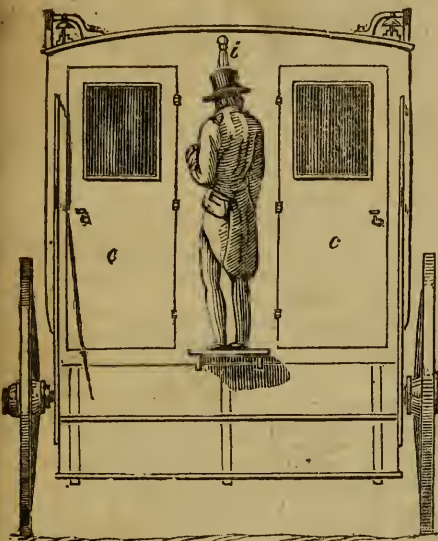
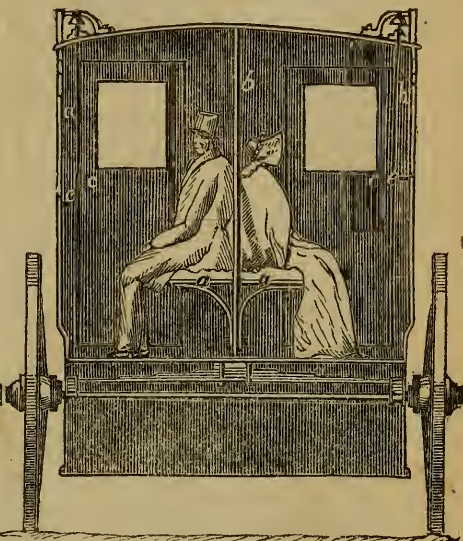
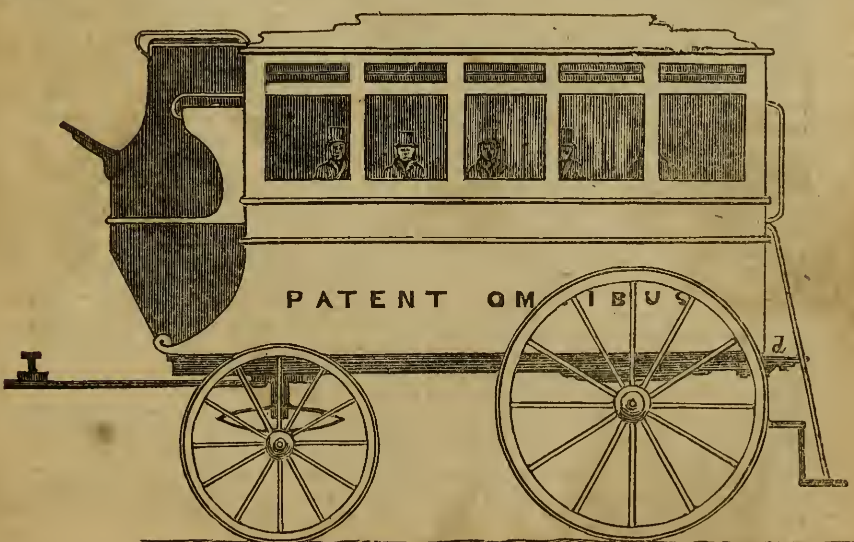


Fig. 2.





City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

NEW PATENT OMNIBUS.

"It must be admitted that among the numerous improvements for the public accommodation which have been introduced during the last few years, none have received a greater share of patronage than the omnibus, in consequence of the great economy it effects both in time and money; and although in the earlier period of introduction, that vehicle had to contend with considerable prejudice, it is now generally encouraged and supported. But while competition has done much to improve the common omnibus in appearance and comfort, there remain extreme defects in its construction and use, which the patent omnibus will effectually remove.

One of the chief objections to the common omnibus, is the great inconvenience experienced in passing to and from the seats; for upon the slightest movement of the vehicle, a passenger may be jolted against the nearest parties, and perhaps thrown down before he can take his seat; this is an objection very constantly felt and acknowledged, and, where ladies are the sufferers, is infinitely more annoying, and sometimes dangerous. To obviate this inconvenience, the patent omnibus is divided into two compartments, by a partition along the centre, and having a row of seats on each side, against the partition, facing the windows; ample room being given for passengers to take their seats. The compartments or sides are entered by distinct doors, and, under the windows, rails are fixed for the use of passengers, so that ladies, invalids, and elderly persons, can easily guide themselves to or from the vacant places.

The difficulty of ventilation hitherto experienced, is obviated with equal certainty and security. In the common omnibus, if the windows be opened, the passengers who are sitting with their backs to them, run the risk of catching cold; this is necessarily the same on both sides of the vehicle, and thus the windows are seldom opened at all. The offensive effluvia arising from want of ventilation in wet or hot weather, is not only exceedingly disagreeable, but also tends to induce headache, faintness, and other ailments. But, from the peculiar construction of the patent omnibus, the passengers face the windows, by which admirable arrangement any degree of ventilation may be kept up without the slightest inconvenience resulting.

There is no doubt that the impunity with which robberies are effected in the common omnibus, may, in a great measure, be attributed to the confusion that occurs while passengers are entering or leaving it, and who have to thread their way, with the greatest difficulty, between the feet and legs of those who are seated; robberies being with more facility effected from the crowding that must occur, when passengers are packed together *vis à vis*, and from the general exclusion of light. In the patent omnibus this evil is fully and effectually remedied; while the better and more certain distribution of light affords a more immediate detection of theft, should it be attempted.

Other improvements are made, among which, and within reach of every passenger, is a check or signal communicating with bells, to indicate the side of the street at which any passenger may desire to be set down, without the necessity of calling out to the conductor; and equal care is taken to afford protection to the passenger in getting on and off the steps, which extend so as to prevent the necessity of stepping into the carriage-way or centre of the street."

The foregoing description is in the inventer's own words; the model is deposited for public inspection, at No. 84, Lombard Street.

It cannot be denied that much inconvenience is experienced by passengers in the omnibuses as at present constructed; and we also admit that much of that inconvenience is obviated by the arrangements adopted in the patent omnibus; but, unless the carriage be made inconveniently broad, there cannot be sufficient space for a tall person to sit in a very easy posture; and it is proposed that the additional width shall be only six inches. There is another objection, of a more serious nature, and which, in the estimation of many persons, will more than counterbalance all the advantages set forth by the projector:—the passenger can only see one side of the road; this will be a great disappointment to those who desire to observe the different objects as they pass, and, moreover, a great impediment to the recognition of the particular spot at which a person may wish to descend, when the place assigned to him in the carriage happens to be on the wrong side. We advise the patentee to seek a remedy for this great inconvenience, before he brings his omnibuses into public competition on the roads. The idea of windows in the partition must immediately suggest itself; but to what extent such arrangement would obviate the evil, and what obstacles may be opposed to its execution, we must leave for the inventer to determine.

Description.—Fig. 1 is a back view of an omnibus constructed according to the invention; fig. 2 is a transverse section of the same; fig. 3 is a side view of the omnibus. *a a* are passengers' seats affixed in the centre of the omnibus; *b* is a partition dividing the omnibus into two compartments; *c c* are two doors which hang clear away from the wheels; *d* is the conductor's step between the two doors; *e e* are two strong hand-rails affixed on the sides of the omnibus, by which passengers are aided in passing from one end of the omnibus to the other; *f f* are bells, to give notice to the conductor; *h h* are check-cords within reach of all the passengers, when desirous of communicating with the conductor; *i* is a handle for the conductor to hold by, when on his step.

MACHINERY FOR COMMUNICATING UNIFORM MOVEMENT TO EQUATOREALS.

A communication has been read to the Astronomical Society, "On the Regulator of the Clock-work for effecting Uniform Movement of Equatoreals," by G. B. Airy, Esq., Astronomer Royal. The author describes the various means which have hitherto been adopted for obtaining a steady and equal motion, none of which have succeeded with the desired degree of accuracy.

"In the mountings constructed by Fraunhofer, the axis of the regulator is vertical; it carries a horizontal cross-arm, to the extremities of which are attached springs, nearly transverse in direction to the cross-arm, carrying at the ends small weights. When the regulator is made to revolve with a certain velocity, the centrifugal force of the balls bends the springs, till the balls just touch the inner surface of a drum which surrounds the regulator. The smallest additional velocity causes the balls to press against the drum, and create a friction, which immediately reduces the velocity; and the drum is made slightly conical, so that, by raising or depressing it, the velocity may be altered at pleasure. This construction not only partakes of the defects common to all the others, but is liable, besides, to this peculiar objection, that the determinate rate will depend most essentially on the strength of the springs, and will, therefore, depend on temperature and other varying causes. The other constructions (which were practically introduced by Mr. Sheepshanks) depend upon the same principle as that of the governor of the steam-engine. Two balls suspended from the upper part of a vertical axis by rods of a certain length, are made to expand by the rotatory velocity of the axis; and this expansion, when it reaches a certain extent, is made to press a lever against some revolving part, and thereby to create a friction, which immediately checks the velocity. In some cases, the balls are suspended by rods from the extremities of a horizontal arm, carried by the vertical axis. This construction, adopted in the south equatoreal of the Royal Observatory, may be considered analogous to Fraunhofer's, substituting for the springs the gravity of the balls—a change which can hardly fail to be advantageous. Now, the uniformity of rotatory motion of the spindle, in these various constructions, depends entirely on this assumption:—that if, upon the whole, the retarding forces are equal to the accelerating forces, the revolving balls will move in a circle, and in no other curve. But this assumption is not correct. If, for instance, we consider the case of balls, suspended as in the governor of the steam-engine; the motion of each of the balls may be the same (omitting the moments of inertia of the various parts of the machine, which are trifling) as that of a ball, suspended by a string, and put in motion by an arbitrary impulse; and a ball, so suspended, may move in a curve differing insensibly from an ellipse. Now, this elliptic motion actually takes place. In some instances, observed by the author, the balls of the regulator, instead of revolving in a circle, revolved in an ellipse of considerable eccentricity, and the rotatory motion of the spindle was, therefore, exceedingly variable. The effect of this irregularity on the motion of the equatoreal, whether the inequalities of motion are followed by the polar axis, or merely communicate a general tremor to the frame, must be injurious. The inequality now mentioned, is only one case of a very extensive theorem, which may be thus enunciated:—'Whenever the equilibrium of forces requires that a free body be brought to a determinate position, either absolute or relative to other parts of the mechanism with which it may be connected, the body will not remain steadily in that position of equilibrium, but will oscillate on both sides of that position, and (so far as the action of those forces affects it) will have no tendency to settle itself in the position of equilibrium.' This theorem supposes that some cause of disturbance has once put the body into a state of oscillation, and renders it necessary to take account of such oscillation in planning any mechanism which depends upon assuming the

position of equilibrium to be nearly preserved. If we examine the theory of the regulator, we shall see that the friction, which checks the motion, takes place when the balls are most distant from the axis, and (as the equable description of areas is nearly observed) this occurs when the angular motion is least. The whole maintaining force acts without check, when the balls are nearest to the axis, that is, when the angular motion is greatest. Therefore, when the angular motion is least, the acting forces tend still to diminish it; when greatest, they tend to increase it. Hence the inequalities of angular motion will increase till some new forces come into play, which act in some different manner: and thus is explained the obstinate adherence of the governor balls, in some cases, to their elliptic motion. The author next proceeds to consider the ways in which an attempt may be made to counteract the injurious effects of such oscillations. These appear to be only two: one, to make the oscillations of velocity much slower (or to make their periodic time longer); the other, to make the oscillations quicker (or to make their periodic time shorter). The first of these methods has the effect of giving greater smoothness to the motion (an object of great importance); and it is the principle which was adopted with success in the clock-work of the Cambridge equatoreal. The second method endangers the smoothness of the motion; but, as the error has but a short time for accumulation, it insures that the object shall remain steady under the view of the telescope, far more completely than the first. The construction attached to the clock-work of the south equatoreal of the Royal Observatory, is on this principle; and it appears to answer well. The mathematical problem proposed by the author in the present communication, is an investigation into the motion of governor balls, for the purpose of deducing the time of rotation corresponding to a given expansion of the balls, and the periodic time of their oscillations, and the consequent oscillations in the angular speed of the spindle."

This subject is discussed with the skill which might be expected from the learned author; but it still remains to discover a means of effecting a motion which shall unite the two great requisites, uniform progression, and the absence of vibration, or tremulous motion in the machine. It is a question which may come within the grasp of every machinist, as no astronomical knowledge is required; it is only necessary to consider a heavy body to revolve uniformly at the rate of one revolution in twenty-four hours. The vibrations of a pendulum, as in a common clock, will not produce the required effect, because the motion would be intermitting; nor is the expanding fly entirely satisfactory, for reasons before stated. We, therefore, advise our mechanical readers to exercise their skill in seeking some contrivance which may supersede those above described.

ON ELECTRICITY.

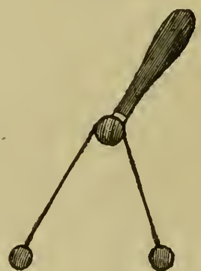
NO. III.

(*Continued from page* 298.)

Upon the principle of electrical attraction and repulsion, we construct instruments termed electroscopes, for the purpose of enabling us distinctly to perceive these phenomena, and to detect the presence of electricity in a body, when it exists only in a slight degree. By them we can also discover, whether this electricity is in the negative or positive state. Instruments which enable us to measure the intensity or quantity of this fluid there is in a body, are termed electrometers.

A very good electroscope, for common purposes, is represented in the annexed figure.

Fig. 1.



It consists of a glass handle, to the extremity of which is attached a brass knob, from which is suspended, by means of two thin silver wires, or hempen threads—previously macerated in a saturated solution of common salt, and then dried—two balls, about the size of a pea, made either of cork or the pith of elder. When the brass knob is brought into contact with an electrified body, its electricity is communicated to the pith balls, which, being thus similarly electrified, immediately repel each other, and diverge. This is, of course, proportioned to the strength of the charge; if there is a small quantity of electricity, they will diverge but little,

and *vice versâ*. Now, if we wish to know whether this electricity is in the negative or positive state, we have only to bring a tube of glass, excited by silk, in contact with the brass knob. If the pith balls are repelled farther, we shall conclude that they are charged with positive electricity; but if they contract, and all electrical appearances cease, with negative. A stick of sealing-wax, excited by flannel, will answer equally well as the glass; but, then, the phenomena observed will necessarily be the reverse of the above.

Fig. 3.

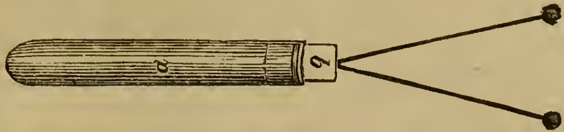
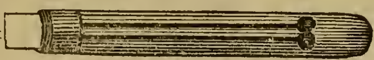


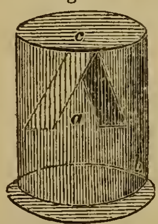
Fig. 2.



An electroscope, contrived by Cavallo, is here represented; it acts in precisely a similar manner to the one we have just mentioned, but is rather differently constructed, and far more portable; *a*, fig. 3, is a tube of polished glass,* rounded at one end, and open at the other, into which a cork, *b*, is fitted, and from which the pith balls are suspended. No farther description is required. When the instrument is not in use, the cork can be reversed, as in fig. 2, and the instrument placed in the pocket.

Where great delicacy, however, is required, an instrument has been contrived by Mr. Bennett, which is termed the gold-leaf electrometer.† It consists of two narrow slips of gold leaf, *a*, fig. 4, which are suspended in a glass cylinder, *c*, to secure them from disturbance by accidental currents of air; when a minute charge of electricity is communicated to the cap, *c*, of this instrument, which communicates to the leaves, they will immediately diverge to an extent proportioned to the strength of the charge.

Fig. 4.



The following instrument enables us to measure the intensity or amount of electricity there is in a body, when collected together. It does not pretend to any great accuracy, but is useful to discover the gross amount of the charge of a Leyden vial, battery, &c It also acts on the principle of the repulsion of bodies when similarly electrified, and is termed the quadrant electrometer. It consists of a

Fig. 5.

round metallic rod, *a*; to the upper extremity of which is fixed a brass ball, *b*. The semicircle of metal, *c*, faced with ivory, divided into 180°, is attached to this rod, from which is suspended, at a point corresponding with the centre of the semicircle, a very thin piece of wood or cane, terminating in a pith ball, *d*, which serves as an index. This hangs perpendicularly when not electrified; but, as soon as a charge of electricity is communicated, it immediately begins to diverge, traversing the semicircle, till it arrives at 90°, when the jar, battery, or whatever it communicates with, may be considered as loaded. The metallic rod, *a*, is fixed in one of the holes on the upper surface of the conductor, when the electrometer is in use.

When we excite an electric, other phe-

* I have heard of one being made with a common vial, which answered very well.

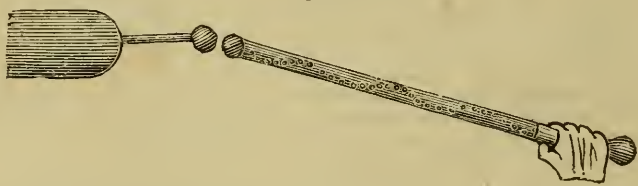
† In fact, only an electroscope.

nomena, besides those of attraction and repulsion, will be observed, if it be of sufficient size. Flashes of light, attended with a snapping sound, will fly off into the surrounding air; and, if the knuckle be presented to any part of the surface, a spark will pass from it to the knuckle, and a pricking sensation will be felt. When the excitation has been continued for some little time, a strong sulphurous smell has generally been found to attend it. From the above we may learn, that the passage of the electric fluid, under some circumstances, is attended with light, and it may be set down as a general rule, that this is always the case when its passage from one conductor to another is impeded by the intervention of imperfect conducting bodies; or, in other words, when there are obstacles in its path. When, however, the electric fluid passes through a perfect conductor, it is unattended with light; for instance, atmospheric air is an imperfect conductor; in fact, when dry, a remarkably good insulator, and when a spark is taken through it, by bringing a brass ball within an inch or two of the conductor of the electrical machine, light is observed. Various have been the opinions as to the cause of this light.

It was believed by the early electricians, that, when the electric fluid had arrived at a certain degree of accumulation, it was itself luminous; but the moderns, in general, hold a different opinion, and, certainly, a more philosophical one; and, without stating at present whether we agree with them or not, we shall here give them. They say, it is well known that, when air is suddenly and violently compressed, it will appear luminous. Now it may reasonably be expected, that the electric fluid exerts a very sudden and powerful pressure upon the air in its passage through that resisting medium; and we are certainly justified in presuming, that the same phenomena proceed in both cases from the same cause. Biot, Professor Brande, and others, have adopted this opinion.

There are some curious and interesting experiments which illustrate the fact, that electrical light is only observed when its passage from one conductor to another is impeded by the intervention of imperfect conducting bodies. Take a glass tube, open at each end, and paste small fragments of tin-foil upon the inside of it, at a short distance from each other in a spiral direction; let a brass ball be attached to one end, and a handle to the other: take the handle in your hand, and bring it to the conductor of this machine when in action, as in the following figure:—

Fig. 6.



A communication is thus made between the conductor and the ground; and such is the rapidity* with which the electric fluid passes, that if the experiment be performed in the dark, the whole spiral will appear luminous at the same instant. Letters, words, and other devices can, in a similar manner, be illuminated, by pasting small spangles of tin-foil at a short distance from each other, upon a piece of glass, as in fig. 7, and bringing the ball, *a*, in contact with the conductor of the machine.

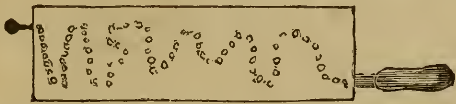
If one end of a chain be communicated with the prime conductor, while the other is held in the hand, it will, in the dark, appear luminous at every link.

The brilliancy of the electrical spark appears to depend upon the conducting power of the body through which it passes. When taken from an imperfect conductor, as wood, for instance, it has a faint red appearance; though brass or silver, which are good conductors, affords them of great brilliancy. Its colour, likewise, is subject to variation; it is not always the same,

* In an experiment made on Shooters Hill, to ascertain the velocity with which the electric fluid moves, it was made to perform a circuit of four miles, at a time that the ground was remarkably dry; being conducted for two miles along wires supported upon baked sticks, and for the remaining distance also, of two miles, through the dry ground. As far as could be ascertained by the most careful observation, the time in which the discharge was transmitted along that immense circuit, was perfectly instantaneous. Nor has any other trial that has yet been made, afforded the least approach to a measurement of the velocity with which electricity moves.

appearing, in a great measure, to depend upon the substance from which it is taken. Thus, if the electric fluid passes between two polished metallic surfaces, its colour is nearly white; but if the spark is received by the finger from such a surface, it will be violet. The sparks are green, when taken by the finger from a surface of silvered leather; yellow, when taken from finely-powdered charcoal: and purple, when taken from the greater number of imperfect conductors.

Fig. 7.



When we wish to collect electricity in a conducting body, we insulate that body; or, in other words, cut off its communication with every other substance, by means of an electric, which, as we have before said, will not conduct electricity; thus, the prime conductor of the electrical machine is insulated by means of a glass leg, or the electricity would be dissipated as fast as it was collected. A person standing on a round board, with an electric intervening between him and the ground, is thereby insulated; and if a communication be made between him and the prime conductor of the machine, he will receive a superabundant supply of electricity, more than his natural quantity; in other words, he will be positively electrified, and sparks can be taken from any part of his body, in the same manner as they can from the conductor of the machine. If highly electrified, the hairs of the head will, being similarly electrified, mutually repel each other, and stand erect.

H. WIGLESWORTH.

The People's Letter-bag and Penny-post Companion, containing Forms of Letters written on Every-day Subjects, and adapted to the use of the Million. By WILLIAM WAVERTON. London: Darton and Clark.

WE have great pleasure in recording the success of this little manual. The second edition, which is now before us, is greatly enhanced in value by the addition of a judicious abstract of the Penny-postage Act, divested of all its legal technicalities and repetitions, but embracing every point of information that is necessary for all the purposes of home and foreign correspondence. It is a practically useful synopsis of the rules and regulations under the new Postage Act, conveyed to the public in a most desirable and agreeable manner.

Now that the postage of letters is reduced to such a trifle, and you can, as it were, shake hands with your distant relatives and friends for a penny, such a work as "The People's Letter-bag" is an aid that will be appreciated by hundreds and thousands of that class of the community, whose epistolary communications prior to the reduction in postage, were, indeed, "few and far between." The formidable expense of a letter, which had to travel 200 or 300 miles, was a barrier to anything like a regular interchange of sentiments among the humbler orders of society. Letter-writing, consequently, is to those persons a very unfamiliar kind of exercise. They will, however, find "The People's Letter-bag" an able auxiliary adapted to all circumstances and occasions. There is most ample supply, indeed there is scarcely any subject of a general or domestic character, that is not included in this *multum in parvo*; and no demand for assistance in communicating any of the incidents and circumstances that attach to ordinary life, is likely to occur, that may not here be satisfied. A work of this kind, which tends so materially to augment the social comforts and enjoyments of the working classes, is deserving of a large circulation, and we heartily wish it success.

DALE READING SOCIETY.

To the Editor of the Mechanic and Chemist.

SIR,—It is with pleasure that I read in the "Mechanic and Chemist," that mechanical and chemical societies are increasing; and, no doubt, the information I am about to give will be received with pleasure. We have a Society here, consisting of upwards of twenty members, called the Dale Reading Society. We have lately introduced voluntary lectures, and find them to answer well during the last quarter. We have had seven lectures on va-

rious subjects, as mechanics, cutlery, botany, &c.; and there are several more in preparation, both on mechanics and chemistry. We take in several periodicals, among which is the "Mechanic and Chemist." I find that the plan of voluntary lecturing succeeds better than the old rule of each member reading or lecturing in his turn; for I found, that the former rule prevented many from joining, and several in the Society objected to it; as, having underrated their abilities, they considered themselves incompetent for the task, and preferred being taught, rather than teaching, at present. Our present plan of lecturing has warmed some of them; for those whom we did not expect, have given us lectures deserving of credit, not only for the way in which they were delivered, but likewise for the trouble in getting them up.

I hope we shall succeed in our exertions, and increase until a Mechanics' Institution is founded on a firm foundation in Coalbrook Dale.

I remain thine, respectfully,

JOHN CHILD, Sec.

Coalbrook Dale, Salop.

[We are much gratified to find that societies, so instructive and eminently moralizing as the one above described, are rapidly spreading over the country. It is our desire to do all in our power to promote their success; and we think that object might be attained, and, at the same time, useful information spread abroad, by publishing some of the interesting communications which, it may be anticipated, such societies will occasionally receive.—ED.]

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, April 29, Dr. Epps, on Phrenology. Friday, May 1, Charles Wood, Jun., Esq., on Spain. At half-past eight precisely.

Poplar Institution, East India Road. Tuesday, April 28, S. C. Horry, Esq., on Trial by Jury. At eight o'clock precisely.

QUERIES.

An inextensible string binds tightly together two smooth cylinders, whose radii are given; what is the length of the string, and the ratio of the mutual pressure between the cylinders to the tension by which it is produced? P. A.

A body is projected in a medium whose resistance $= k$ (velocity) ^{n}, and is acted on by no extraneous force; what will be the whole space described, and the whole time of motion for all values of n? P. AMER.

TO CORRESPONDENTS.

NOTICE.—*Preparing for publication, a beautiful Engraving on copper of the Great Western Steam-ship. The above Plate will be given to every purchaser of the Index to Vol. V. of the "Mechanic and Chemist," which will appear in a week or two, the present being the closing Number of that Volume.*

E. L.—*The method of tempering springs has been fully explained in the "Mechanic;" and it is known to every steel-worker in the kingdom.*

A. Hodge's *garden pots are deficient in two material points—utility and ornament His invention is not, as he surmises, of* too delicate a nature for insertion, *but too inferior to those in common use. His manuscripts and drawings shall be returned in the manner he desires.*

P. Amer.—*We shall be glad to receive his abstract of Mr. Coombe's lecture on the effects of machinery on the working classes. We avail ourselves of the interesting papers he has favoured us with, excepting only that on electricity, which subject he will find treated in a series of papers, with minute and practical explanations, which will be found especially valuable to the amateur experimentalist.*

A Correspondent *will find the process of making fluoric acid in a recent Number of the "Mechanic," in a paper on acids by our much-valued correspondent, "J. Mitchell."*

P. P.—*We have received his model, &c., which will be left for him at the "Mechanic" Office, Long Lane, with our opinion. He will please to send his signature, to prevent mistake.*

G., a Consumer, *in our next.*

GRANT'S LONDON JOURNAL,

A Cheap Publication of Popular Literature.

THE Number of GRANT'S LONDON JOURNAL, conducted by the Author of "Random Recollections," "The Great Metropolis," &c. &c., which will appear on Saturday, May 2nd, Price Twopence, will contain the first of a Series of Articles on

PICTORIAL PRINTING,

And will be illustrated by a large number of elegant Designs, in a style never before attempted in this country. As an unusually large demand is expected for GRANT'S JOURNAL of the 2nd of May, and the succeeding Numbers containing the Pictorial Illustrations, orders ought to be immediately given, to prevent disappointment.

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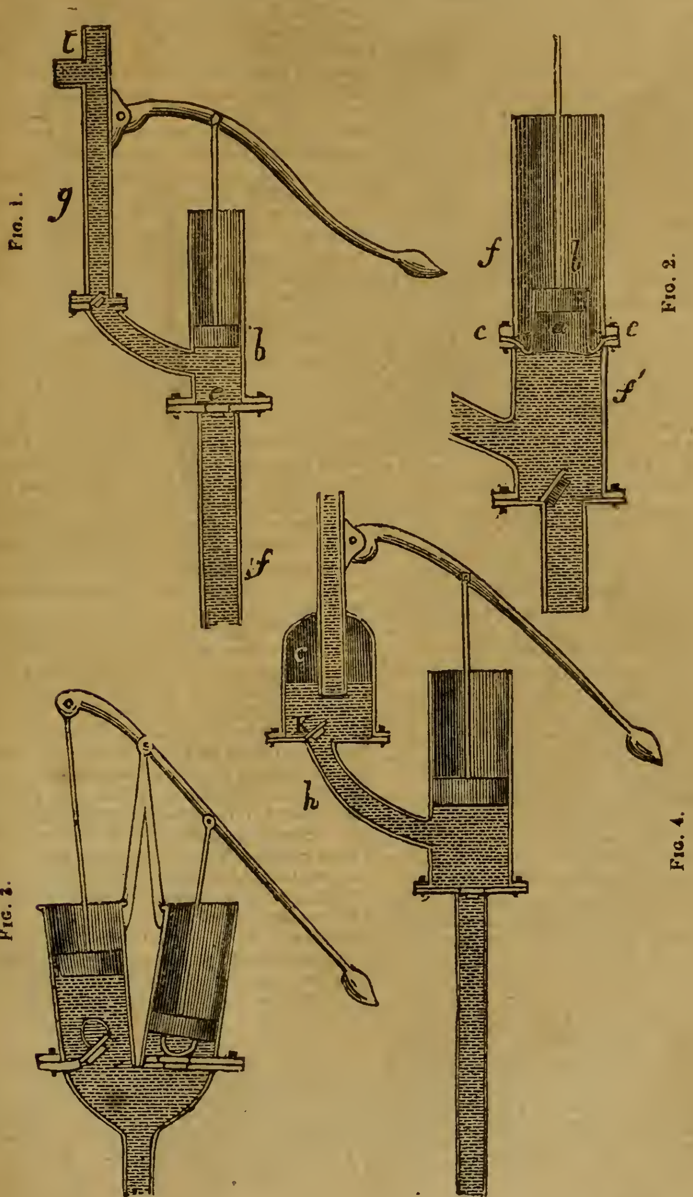
London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street. Strand; and may be had of all Booksellers and Newsmen in Town and Country.

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 90, NEW SERIES. | SATURDAY, MAY 2, 1840. PRICE ONE PENNY. | No. 211, OLD SERIES.

CONSTRUCTION OF PUMPS.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

HISTORY AND APPLICATION OF THE PUMP.

NO. II.

(See Engraving, front page.)

In my last paper, I endeavoured to explain, that those pumps which depend entirely upon atmospheric pressure for their action, are incapable of drawing water from a greater depth than thirty or thirty-two feet; yet water may be raised by them to any required height above that, by lengthening the pipe above the piston, and placing the cistern and discharging orifice at the top of the pipe. But there is a great inconvenience attending this contrivance, for the piston-rod, if extended to any great length, is extremely liable to bend, and thus materially deteriorate the working of the machine. In those situations, therefore, where it is required to draw water from any great depth, or to raise it to any great elevation, the forcing pump is generally employed, of which there are various modifications. The following is a description of one of the simplest construction of this class of pumps:—*a*, fig. 1, is a truly-bored hollow cylinder, having a solid air-tight piston, *b*, working within it; *f* is the feeding-pipe, with a valve, *c*, at the top, opening upwards; *g* is the ascending pipe, and *t*, the discharging orifice. Now, when a vacuum is formed in the working barrel by the elevation of the piston, the water is forced up the feed-pipe through the valve, *c*, into the barrel or body of the pump, by the external atmospheric pressure; and the moment the piston is lowered, the valve, *c*, closes, which effectually prevents the return of the water to the cistern; it is, therefore, forced up by the piston through the valve, *p*, into the ascending pipe, *g*, from which it is discharged at any required height.

This kind of pump is applicable to many purposes connected with the arts; it is generally considered to be one of the most useful machines of the kind we possess. In addition to its evident utility in raising water to great elevations, there is an extraordinary degree of power to be obtained by it, which is beautifully exemplified in the place it occupies in the hydrostatic press.

The piston of this pump, it will be seen, requires to be made, so as to fit the interior of the working barrel with such accuracy, as to effectually prevent the passage of the least particle of water between them, which is generally accomplished by introducing flannel, hemp, or some other soft material between the piston and cylinder. This contrivance, however, occasions a considerable deal of friction against the interior of the cylinder, which renders it extremely hard to work. This is, in some degree, obviated, by introducing a leather collar between the piston and cylinder, which allows the piston to work its full stroke without the least friction, and renders it perfectly air-tight, as shown in fig. 2; *b*, the piston; *a*, the collar, fastened to the piston, and to the jointed cylinder, *f f*, by means of screws, *c c*.

A pump made on this principle is, however, incapable of maintaining a constant and equable flow of water from the ascending pipe, *l*, in consequence of the almost imperceptible elasticity of the water, preventing its receiving the contents of the cylinder, without putting the whole of the water contained in the pipe in motion, which motion might be continued with less force than originally employed, if the piston kept moving upwards; but the descent of the piston allows sufficient time for that motion to be lost. This is, however, remedied, by having two or more pumps to discharge their contents into one ascending pipe, by means of a working handle so arranged, that each piston shall be alternately elevated and depressed (as shown in fig. 3), in which case it is never in a state of rest; for as soon as it has received the contents of one pump, the other is ready to discharge itself, so that a constant and equable current, or flow of water, is maintained at the discharging orifice.

The most beautiful plan for preserving a constant flow of water from one forcing-pump, is shown in fig. 4; it is effected by the introduction of an air-vessel, *c*. The water being forced up the lateral pipe, *h*, by the depression of the piston, enters the air-vessel by the valve, *k*, and condenses or compresses the air contained therein, so that when the piston is elevated for the purpose of giving another stroke, the valve, *k*, is closed, and all motion in the lateral pipe ceases. The compressed air, in its effort to expand and assume its original bulk, exerts a pressure on the surface of the water, which forces it up the perpendicular pipe, *l*; so that, whether the piston be performing its upward or downward stroke, the water is continually ascending the pipe by the action of the air-vessel.

EPICTETUS.

Gigantic Monkeys.—A communication has been read to the Geographical Society, from Mr. James Brooke, who had passed some time in the interior of Borneo, describing two distinct species of ourang-outang, the larger of which varied from six to seven feet in height!

JUGGINS'S PORCELAIN WEIGHTS AND WEIGHING PLATES.

The inventor of this excellent contrivance, is Mr. William Juggins, 22, James Street, Covent Garden. Besides the advantages set forth in the following paper, which we have received from the manufacturer, these weights will, by the incorruptible nature of the material of which they are composed, afford a satisfactory guarantee of their accuracy to the public, and, at the same time, protect tradesmen from the disagreeable consequences of the scrutiny of the annoyance jury, which cannot always be guarded against, when the ordinary metallic weights are used, owing to their liability to wear and to corrode. The same reasoning will also apply to the weighing plates; for every time the metal plate undergoes the operation of scouring, it loses something of its weight, to the prejudice of the seller. Mr. Juggins thus explains the use of his invention:—

"Notwithstanding the many attempts that have been made to introduce to the trading public, a composition for the manufacture of weights that will resist the action of the atmosphere, and the different articles sold, such as salt, &c., causing much inconvenience, both as regards their being continually out of order, and the filthy state they are always in from the above causes, all have hitherto failed to remedy the evil.

The inventer of the present improvement, in submitting his weights to the notice of the public (which have been highly approved of by the Society of Arts and Sciences, and for which he has received a silver Isis medal), begs to state the following advantages which may be derived from their use:—

In the first place, the atmosphere and other causes before named, have no effect on them; secondly, they are very superior in appearance to the old iron weights; thirdly, in point of cleanliness; and, fourthly, remaining in a perfect state, as from the material they are composed of, they cannot wear like the ordinary weights.

The inventer flatters himself that, from the many advantages that will be gained by their use, it will insure to him the liberal encouragement of the public.

Juggins, of James Street, Covent Garden, invented and introduced to the public notice, a few years since, his butter-plates and stands of a similar composition; the encouragement he has met with, and the sale of which far exceeding his most sanguine expectation.

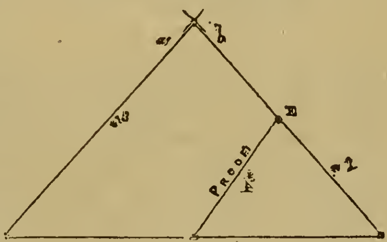
Juggins's improved Weighing Plate and Butter-stand.

The advantage to cheesemongers, butchers, and all dealers in eatable commodities, from this improvement, will be obvious to those who are practically acquainted with the defects of the scale-plate, now in common use:—First, the action of the atmosphere producing no alteration on it; second, in cleanliness, which is an advantage to buyer and seller; third, effecting a great saving of time in scouring and cleaning, as well as of wear and tear in the scale itself; fourth, the appearance being ornamental as well as useful. The scale will also be found worth the attention of chemists, grocers, colour-dealers, and all articles requiring genuineness and purity. And the butter-stand cannot fail to be appreciated by every tradesman, both as to neatness and economy."

We may add, that this invention has received the sanction of the Society of Arts, and was ordered for publication in the second part of the 50th volume of their Transactions.

LAND SURVEYING.

To Survey the Triangular Field, A B O.



A D 1* B

One of the most important instruments in land surveying, is the chain, which was invented by the Rev. E. Gunter, a celebrated professor of geometry about 200 years ago. It is divided into 100 equal parts, called links, each one being 7.92 inches; the total length is four poles, or sixty-six feet; at every ten links are pieces of brass, for facilitating the counting of odd links. The off-set staff is ten links long, and is very useful in measuring from the chain line to the bends in the fences, &c. The field-book is ruled into three columns; the middle column is used for noting the progressive distances measured with the chain; and the others for the offsets taken on the right and left-hand sides. It is necessary, also, to sketch the fence in the field-book as you proceed, as it assists you very much in

plotting your work; and you are also enabled to note on which side of the fence the ditch is, whether the adjoining land is arable or pasture, names of owners, &c. It is best to begin taking notes at the bottom of the book, and write upwards.

Having set up marks at A B and O, you commence at A, and measure towards B; and when you arrive at D, a station must be made in the ground, and noted in the field-book (as this will be required for the purpose of proving the survey); from B, you measure towards C, putting down a station at E; from C, measure towards A; from D, measure towards E, and the survey will be completed. The notes in the field-book will stand thus:—

	460	to 500 in 2.
	4*	at 600 in 1.
	908	to end of 1.
	3*	at end of 2.
	908	to o in 3.
ρ	500	
	2*	at end of 1.
	1200	to o in 2.
ò	600	
	1*	

Thus it will be seen, that at 600 links on the first line, a station is left, and the line is 1200 links long; the second line begins at the end of the first (leaving a station at 500 links), and goes to 0 in the third; the third line begins at the end of the second, and goes to 0 in the first; the fourth line (the proof) begins at 600 in 1, and goes to 500 in 2. The next thing is, to plot the work upon paper, which is done in the following manner:—Draw the line A B = 1200 links, marking the station at 600; take a pair of compasses, and, with B as a centre and radius = 908 links, describe the arc, *a a*, with A as a centre, and the same radius describe the arc, *b b*; draw lines to the point of intersection, and the field will be plotted. Lay your scale from D to E, and if it be 460 links, the work is right. To find the area of the field, multiply the length of the base by half the perpendicular, and it will give it in square links; then reduce it to acres, roods, and perches, by multiplying by 4 and by 40, cutting off five figures to the right hand for decimals, thus:—

$$1200 \times 341 = 409,200 \therefore 409,200 \times 4 \;\&\; 40 =$$

A.	R.	P.
4	0	15

G. R.

LIFE ASSURANCE.

NO. IV.

PROFITS.

THE rates of premium of three offices in London, which were pointed out in our last chapter, are those charged annually to assure any person at death, 100*l*., together with all the profits (that is, a proportionate share, according to the interest each person had in such society); and such profits are ascertained, made known, and divided among all the members assured, every year.

This mode is the more equitable on several accounts; first, because, as has been shown, every Society will in some years find fewer persons die than was set forth in their tables of *expectancy*, and upon which their rates of premium were calculated; and, consequently, some money will have been received by such Society, beyond the actual risk which it has incurred on behalf of such persons. But this fact can only be ascertained by trial and experience.

Secondly, an annual division of whatever profits a Society may realize, is more just than either quinnial, septennial, or deceminal divisions; inasmuch as numbers may die before the period of division arrives, when such period occurs but once in five, seven, or ten years; and thus another person, most probably a stranger, becomes possessed, not by right, but by a mere change of circumstance, of that portion which should have been assigned to the property of the person who died before such division took place. And a moment's reflection will show, that although a greater share of profits will accrue to those who survive the long period of division, yet, by an annual distribution only, can the profits be fairly divided, however small they may be in consequence of such a method.

Thirdly, the reason for dividing all the profits among the several members is obvious, when we consider, that whatever premium a person pays into an Assurance Society for a promised sum of money, it is deemed and understood at the time to be a sufficient sum for purchasing such a benefit; and that, necessarily, whatever gain a Society may make by putting out such premiums to a better interest than had been estimated; or, by any other method, all such gains, after paying for the expenses of management, belong, strictly speaking, to the members alone; and, in those Societies we have mentioned, and in several others, these are privileges which

they allow, and which places them so much above Societies based upon the joint-stock principle, a subject which we shall speak of in its proper place.

It may be, perhaps, necessary to state what is particularly meant by the word *profit*, which we have so frequently used, and for that purpose we say that, after certain sums of money have been contributed to a Society in the shape of premiums for a promised benefit at a future period, the Society is supposed to have taken the exact amount of money which, if put to interest at three per cent. generally), will meet all the risk it expects to incur on behalf of those persons for that year; so that all who do not die as expected, have paid the Society for a risk which it has not actually run, which has been before observed. And, again, as various means are open by which a greater interest can be made by a Society of its funds, than the three per cent. which had been calculated upon, the results of these circumstances are, to such an extent, the successful gains of the Society for that year. Now suppose, for example, that 20,000*l.* has been paid to any Society for the premiums of one year from the several assurers (which are paid in advance), and that this sum has been improved at interest to the amount of 21,090*l.*; suppose further, that 8,000*l.* has been realized from the investments of the former contributed premiums, called the funds of the Society, beyond what had been calculated upon in the tables; this would then amount to 29,000*l.* Now, in case that no fewer number of assurers die, or make a claim in that year, than was expected to do so, here will be a large surplus of profits, in proportion to the premiums paid for that year, which ought to be divided among the assurers in calculated proportions; and suppose, as may probably be the case, that only 15,000*l.* out of the 29,000*l.* accruing to the Society in that year, will be necessary to be added to all the former premiums paid, to meet every present liability* which the Society is under; then the overplus (14,000*l.*) will constitute the Society's profits for that year; say, deduct a small portion to defray the yearly expenses, and the remainder to be divided among all the assurers in calculated proportions. The greater part of these profits will not, perhaps, be drawn out of the Society, but suffered to remain to accumulate for the succeeding year, and the division of profits may be quite as favourable then, as on the last occasion.

Should the reader consider that there may be greater claims upon a Society than had been expected in one year, and wish to know how these claims will be met, we reply, that this certainly may be the case, but that a Society, if based upon just principles, will have made a provision for this contingency, by calculating in a former year its then present liabilities, and declaring its profits, or real surplus funds, accordingly; so that the gains for such a year of greater risk, if not augmented to the several assured beyond the past year, would not be lessened to any of them one iota.

SIGMA.

* By present liabilities, must be understood the immediate demands which every member would be entitled to make upon the funds of the Society, were he to offer to withdraw his share, and cancel the promises contained in his policy. —*Hardy.*

ANTISEPTIC PROPERTIES OF PEAT.

PEAT possesses the remarkable quality of preserving animal substances for any length of time. In June, 1747, the body of a female was discovered in a peat moor in the Isle of Axholm, in Lincolnshire. Her feet were furnished with antique sandals, and it has been supposed that she was an ancient Briton. Her nails, hair, and skin, are described as having shown scarcely any symptoms of decay. In Ireland a human body was dug up, which was completely clothed with garments made of hair. The clothing of the inhabitants was manufactured from this material before the introduction of wool; but many ages have transpired since this took place, so that the body must have lain an immense time; yet it was perfectly fresh and unimpaired. At the battle of Solway, in the time of Henry the Eighth, when the Scotch army, commanded by Oliver Sinclair, was routed, an unfortunate troop of horse, driven by their fears, plunged into this morass (the Solway moss), which instantly closed upon them. The tale was traditional, but it is now authenticated—a man and horse, in complete armour, having been found by peat-diggers in the place where it was supposed the affair had happened. The skeleton of each was well preserved, and the different parts of the armour easily distinguished. Besides the human body, there have been found in peat bogs, bones of the stag, ox, horse, hog, sheep, and other animals that feed on herbs; and in Ireland, and the Isle of Man, skeletons of a gigantic elk. With regard to the question, whence peat

derives its antiseptic property, it has been conjectured by some, that the carbonic and gallic acids which issue from decayed wood, and also charred wood, which occurs in the lower parts of many peat mosses, may account for it. Vegetable gums and resins will also have this effect. The power of tannin to prevent decay is well known; and its presence in almost all trees, but particularly in the oak, is also well known. Peat beds occupy the sites of forests, especially those of oak and pine; so that tannin, in these, at least, must have been present in great quantities. It may have entered into various combinations, but that it really is to be found in such peat bogs, and to a considerable extent, either in a simple or compound state, appears to be beyond a doubt.

P. Amer.

CURIOUS ANCIENT RECEIPTS.

One may colour ivory, or any other bones, with an excellent green colour, as followeth:—Take strong water, called aqua-fortis, wherein dissolve as much copper as the said water is able; then let the bones you would have coloured, lie in the same all night, and they will be a smaragdine colour.—*Mizaldus.*

All things that come out of the earth, will swim upon quicksilver, though they be heavy, except gold; and gold, though never so little, will sink into it, and be swallowed thereof, and its colour will be turned into silver, which cannot be reduced into the form of gold again, but with fire, nor can be gotten out; and the quicksilver, through the fire, will be dissolved into a smoke, with a perilous smell. —*Mizaldus.*

That writings shall not burn in the fire, take very strong vinegar and the whites of eggs, and put them together; and put thereto quicksilver, mixing and stirring the quicksilver well therein, and with the same mixture anoint paper three times, and, after that, write what you list upon the same paper, and then cast the same writing into the fire; it will not burn.

An egg laid in strong vinegar three days, or a little longer, it makes the shell thereof so tender and soft, that one may draw it through a ring. Cast the same into warm water, and let it lie therein, and it will be hard again.—*Mizaldus.*

Water wherein the leaves and seeds of hemp are sodden, being cast or sprinkled on the earth, will make the worms to come out of the ground, if any be there.—*Mizaldus.*

If some drops of aqua-vitæ be mixed with writing ink, the same will never freeze.—Proved.

Hempseed given to hens in winter, will make them lay eggs apace.—*Gardanus.*

Burning water, called aqua-vitæ, is of a marvellous force in preserving of things, and keeping them from putrifying. For flesh or meats whatsoever moistened therewith, will be safe from corruption and worms.

To separate gold from silver, do thus:—Anoint the silver that is gilded, with oil of linseed, and sprinkle thereon the powder of roach alum and salt armoniack, mixed together; which, being well heated in the fire, and quenched in water, the separated gold will remain therein.—*Mizaldus* had this of a cunning goldsmith.

If one that hath eaten garlick or cummin seed, breathe on the face of a woman that is painted, the colour will vanish away straight; if not, then her colour remains as it did before.—*Lang.*

Grind mustard with vinegar, and rub it well and hard on the palms of the hands or soles of the feet, and it will help and quicken forgetful persons.—*Petrus Hispanus.*

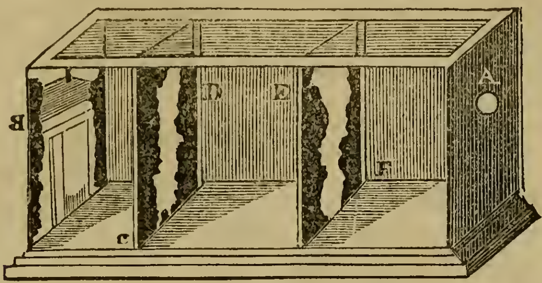
If a large round vessel, with one hole on the top thereof, be filled with quicklime and brimstone, of both equal portions, and the hole well stopped, that no air nor anything may go out, and so put in some standing water, or a little pit of water, or into some cistern full of water, it will keep the said water hot a long time, or for many days.—Proved of many, saith *Mizaldus.*

If you would have copper to melt quickly, and run easily, put the hoofs of a horse into the same, between the melting and pouring out thereof.—*Mizaldus* had this secret of an expert Italian.

THE ARTIFICIAL LANDSCAPE.

Procure a box of about a foot long, eight inches wide, and six inches high; at each of its opposite ends, on the inside of this box, place a piece of looking-glass that shall exactly fit; but at the end, where the sight-hole, A, is, scrape the silver off the glass, through which the eye can view the objects. Cover the box with gauze, over which place a piece of transparent glass, which is to be well fastened in. Let there be two grooves at each end of the places, C D E F, to receive two printed scenes, as follows:—On two pieces of pasteboard, let there be skilfully painted on both sides, any object you think proper as woods, bowers, gardens, houses, &c.;

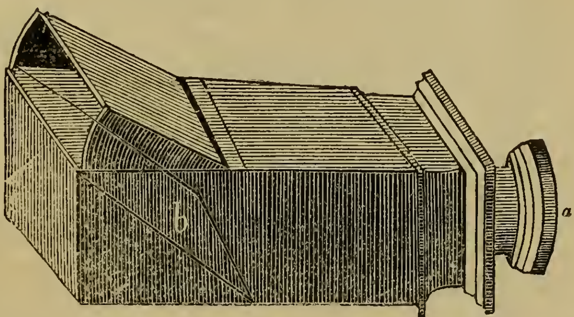
and on two other boards the same objects on one side only, and cut out all the white parts; observe also, that there ought to be in one of them some object relative to the subject placed at A, that the mirror placed at B, may not reflect the hole on the opposite side. The boards, painted on both sides, are to slide in grooves, C D E F; and



those painted on one side, are to be placed against the opposite mirrors, A and B; then cover the box with its transparent top. The box should be placed in a strong light, to have a good effect. When it is viewed through the sight-hole, it will present an unlimited prospect of rural scenery, gradually losing itself in obscurity, and be found well worth the pains bestowed on its construction.

E. LEDGER.

PORTABLE CAMERA OBSCURA.



THE camera obscura is a most amusing optical toy. The above is a box constructed for this purpose. A magnifying glass is placed in the wooden tube, *a*, and the object is thrown upon the angular mirror, *b*. A complete picture of the most extensive view may thus be obtained in the space of a few inches, and the box may be carried in the pocket of the observer.

E. LEDGER.

Luminous Insects.—There are eighteen species of lampyris or glow-worm, some of which are found in almost every part of the world. In many of these species, the females have no wings, and are supposed to be discovered by the winged males by their shining in the night. They become more lucid when they put themselves in motion, which would seem to indicate that their light is owing to their respiration, in which process it is probable phosphoric acid is produced by the combination of vital air with some part of the blood, and that light is given out through their transparent bodies by this flow of internal luminous fluid. There is a fire-fly of the beetle kind, known by the name of acadia, which is said to be two inches long, and inhabits the West Indies and South America. The natives use them instead of candles, by putting a sufficient number under a glass. And it is said that Madam Merian did paint and finish one of them in her work on insects, at Surinam, by its own light. The largest and oldest of them are said to become

four inches long, and to shine like a shooting star as they fly, and are, on this account, called lantern bearers. W. C. D.

The Artificial Volcano.—Take nitre and cream of tartar, of each one ounce; reduce them to a fine powder; add to them a little powdered charcoal, and raise the whole into a heap in the form of a pyramid. Set fire to the vertex, and the clouds of smoke, the flashes of light, the hissing noise, and the torrents of red-hot lava which roll down the sides, entitle it to the appellation of the artificial volcano. The residuum is vegetable alkali, which may be kept in bottles for use.

E. LEDGER.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 6, Dr. Epps, on Phrenology. Friday, May 8, C. Johnson, Esq., on City Gardening. At half-past eight precisely.

Poplar Institution, East India Road.—Tuesday, May 5, Rev. F. Bishop, on Pneumatics. At eight o'clock precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 7, A. Morton, Esq., on the Mechanical Powers (in conclusion). At half-past eight.

QUERIES.

Of what vegetable, and by what process lactucarium is made? Also, how to rectify spirits of wine? Lastly, how to analyze all the different sorts of ink, such as blue, black, red, printing, &c.? X. Y. Z.

This is an age of inventions. What great benefit could be done to that class of people who have an impediment in their speech, if some sort of instrument could give plainness to the words being uttered! Marbles I tried, but it was no good. Perhaps in giving this a place in your Journal, some surgeon, chemist, or others, might undertake it? A SUFFERER.

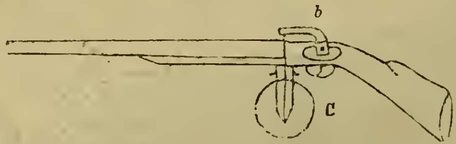
The manner in which the matches for lucifers and congreves are cut; and if by a machine, a description of such? Also, how to extract the stoppers out of smelling and other bottles; having tried the usual methods, but have failed?

S. G. H.

Having to construct receivers for the making of spirit of salt, and a chamber for the making of chloride of lime, to be done with brickwork, please to inform me what cement is the most durable, and the way of preparing it? Also what is the composition of cow-dung? What are the effects of it on the different mordants of calico-printers? SCIO.

1. How to stain and varnish violins of a dark colour? 2. How to refine rosin, such as is used for violins? 3. How to make gold and silver bronze powders? E. LEDGER.

ANSWER TO QUERY.



I beg to inform "Wm. V—e," that the air-gun is much the same as a common musket, with the addition of a round ball, c, which contains the condensed air, into which it is forced by means of a syringe, and screwed to the barrel of the gun. There is fixed to the ball a valve opening inwards; and when the leaden bullet is rammed down, the trigger is pulled back, which forces down the hook, *b*, upon the pin connected with the valve, and liberates a portion of the condensed air, which, rushing through a hole into the barrel, will impel the bullet to a great distance. E. LEDGER.

TO CORRESPONDENTS.

X. Y. Z. *may clean a vessel which has contained balsam, or fluid resin, by washing it with alcohol, or oil of turpentine. How to use a retort, can be explained by any person who has occasion for one.*

M. T. N.—*The hydraulic machine he describes, will not produce the effect he anticipates. No force can be exerted in any direction without a corresponding and equivalent reaction in an opposite direction.*

S. Sandy.—*If he will be pleased to call or send to our office, he will receive the information he requires.*

A Subscriber *has partly anticipated our intentions: but we do not think it would be expedient to reject all matter not immediately relating to science.*

Novicius. *The intense light employed for the oxyhydrogen microscope, &c., is produced by a combined current of oxygen and hydrogen projected against a piece of lime. The two gases are contained in separate vessels, and their relative quantities regulated by cocks; the brightness of the light indicating the proper proportions.*

ERRATUM.—Page 293, last column, question 3, for "sides" read *bodies*.

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THE

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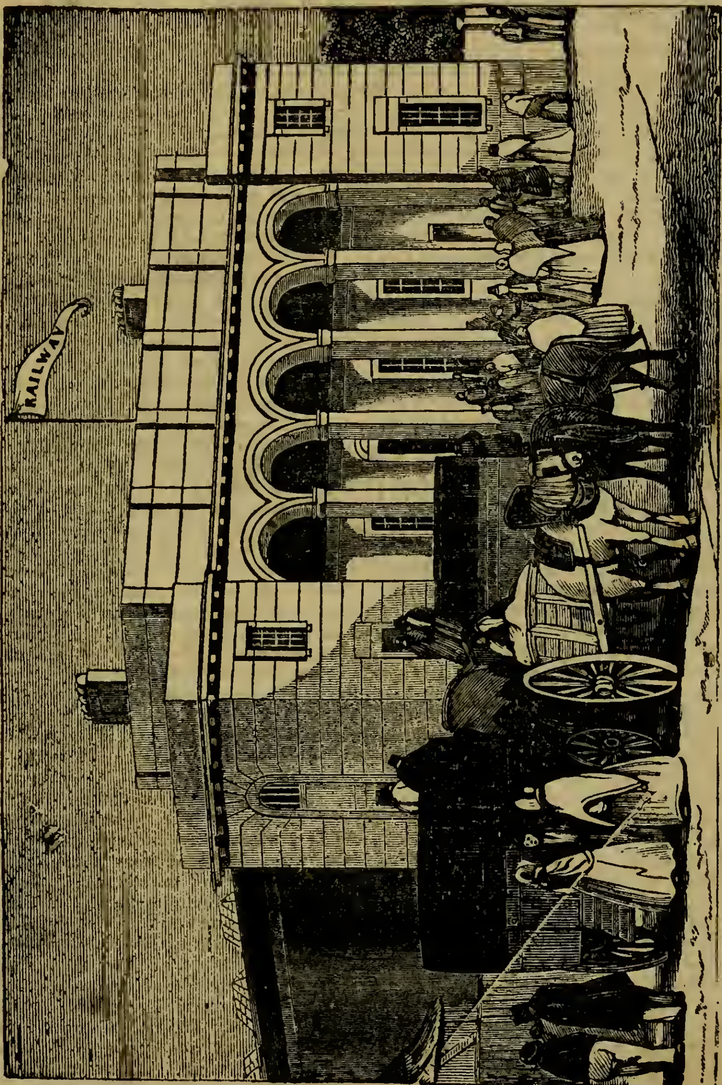

VIEW OF THE ENTRANCE TO THE LONDON AND SOUTHAMPTON RAILWAY.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

LONDON AND SOUTH-WESTERN RAILWAY.

In our front page is a view of the London entrance to this great and valuable work. The line of communication between London and Southampton is completed, and was opened to the public on Monday, May 11. This affords another, and, beyond all doubt, a finer and more delightful outlet from the metropolis, than any that modern ingenuity and enterprise have yet afforded. Journeying by railway, we measure distance, not by miles, but minutes; and, adopting this scale, it may be safely said, that Southampton, the Isle of Wight. and the charming neighbourhood of the New Forest, are now little more distant than Gravesend, and considerably more within our reach than Ramsgate and Margate. The traveller, urged by business, or the tourist, seeking change, taking his seat at Nine Elms at eight o'clock in the morning, is gladdened by the smiling beauties of "the island," or plunged in the depths of the New Forest, before the chimes of town or village steeples in these far-off and delicious regions ring out the hour of noon. Three hours of easy travelling bring him half way down the Channel, place him in the midst of the most charming scenery in England, or set him well on his route to Paris. Henceforth the relations between Southampton and London are changed; nor can the time be distant when the magnitude and national importance of the change will be as fully appreciated as they are manifestly apparent. Some of the directors, and a large party of their friends, made an excursion along the whole line on Monday, starting from London at eight o'clock, and reaching Southampton, after several long and somewhat wearisome stoppages to increase, at different stations, the freight of passengers, at half-past eleven. And here we cannot but express our regret, that the chairman and several of the directors were prevented from being present, by the necessity of attending the proceedings in the Vice-Chancellor's Court, arising out of the opposition of a joint-stock company, called the Northam Bridge Company, who are endeavouring to obtain an injunction to stop the traffic of the railway within a mile of the terminus at Southampton. That any Company, whose interests are identified with Southampton, should so misconceive their own, and so blindly seek to impair those of the town, by throwing obstacles in the way of this undertaking, appears marvellous; and when it is considered that the Northam Bridge Company is composed of many of the leading gentlemen in Southampton, their conduct cannot fail of exciting general surprise. But we return to our description of yesterday's occurrence. The importance of the occasion seemed to be fully felt by the inhabitants of the neighbouring county, even from Wandsworth to the termination of the line; for, at every resting-place, thousands had assembled to greet with lusty cheers the art-impelled and rapid-moving carriage hereafter to diminish, by at least two-thirds, the distance between them and the world's metropolis.

On the arrival of the train at its destination, a deputation of the townspeople waited upon the directors to request them to fix a day for visiting the town, and partaking of an entertainment. The compliment was very cordially received, but, in the absence of the chairman and a portion of the directory, no day was fixed.

Nearly two hours were delightfully loitered away at Southampton—the speculative attracted to an inspection of the works actively going on in the formation of the docks—the lovers of the picturesque hastening to snatch a hasty glance at the beauties of Netley Abbey—the simply idle sauntering into the town. Soon after one o'clock the party again assembled, and set out on their return. The "smokin', boilin', screamin', bustin' monster," as Mr. Weller describes the engine, was attached to the train, and, in a short three-quarters of an hour, the venerable towers of Winchester were left in the rear, and the Andover-road station was gained. Here Mr. Brassy, one of the principal contractors, had made arrangements, upon a most extensive and liberal scale, not only for the entertainment of the directors and their friends, but for the feasting of the labourers employed in the construction of the works. Marquees, amply set forth with delicate viands and rare wines, afforded refreshment to the former, while the latter were made happy by lusty slices from the sides of a roasted ox, and an unlimited supply of strong beer. The scene at this point was extremely animated and cheering. The gay streamers that flaunted from the spiral summits of the marquees—the branches of evergreens and flowering shrubs that embowered the station-house—the throng of smartly-dressed visiters—the host of hardy, well-washed, merry-looking labourers—and, though last not least, the numberless groups of healthy, buxom country lasses, presented a *coup d'œil* that will not easily be forgotten. When due honour had been paid to the

MISCELLANEA.

Turning Lathes.—At the ordinary meeting of the Society of Arts on Wednesday, the large silver medal was awarded to Mr. J. Hick, jun., of Bolton, for an improved expanding mandrel for turning lathes. It is necessary that a mandrel should fit so accurately, as to bite on the inner surface with a force sufficient to counteract that of the tool, and, in the ordinary mode, the same mandrel cannot be used for two pieces which are of different diameters. Consequently, in many engineering establishments, a stock of mandrels is kept, amounting to 600 or 700. Mr. Hick purposes to do the same work with eight sizes of the mandrel, from one inch and a quarter to ten inches. He effects his object by having the spindle of the mandrel shaped on the frustrum of a cone, on the face of which are four dove-tail grooves to receive wedges, the under faces of which have the reverse inclination of the cone; so that the lines of their outside faces are always parallel with the axis of the mandrel. A nut is screwed on the spindle, which acts on the wedges through the medium of a conical cup, which drives them up to their bearings inside of the work.

Steam-boilers.—At the last sitting of the Society for the Encouragement of National Industry, and on the report of M. Seguier the younger, a gold medal was decreed to the elder M. Chaussenot, for an apparatus to render the explosion of steam-boilers impossible. According to the report, his invention is perfect, both as regards its improvements on the safety-valve, and an ingenious contrivance to give notice to the crew and passengers of impending danger. Even the contingency of wilful mischief is provided against; as, in the event of all the warnings of his machinery failing, or being disregarded, the steam flows back upon the furnace, extinguishes the fire, and destroys all possibility of an explosion.

Society of Arts.—After the lecture on Wednesday, Mr. Smee exhibited his new galvanic battery. The elements of the battery were silver and zinc, and the exciting fluid dilute sulphuric acid. So far there was nothing new or uncommon; but the negative plates were not simply silver, but silver platinized, by having a layer of that metal deposited on their surfaces by galvanic agency; thus creating an immense number of points from which the hydrogen might be thrown off, and, at the same time, insuring complete contact with the exciting liquid. Mr. Smee stated, that the advantages of this battery were, the cheapness of the exciting liquid, the little trouble it required to keep it in order (for, when done with, it only required to be taken out of the acid, and it is ready for use at a minute's notice), and the absence of all injurious fumes. There is an immediate cessation of action in the cells when the circuit is interrupted, which prevents any waste of the material when the battery is not in use.

The Burning Coal Mines of Commentry.—This extensive and destructive fire has been incessantly burning from 1816 to the present time, without making any great apparent progress, recently, as described in a former Number. The mayor of the commune writes as follows to a Paris journal:—" The mines of Commentry are worked at once subterraneously and beneath the open sky. Of late years, this second mode has been preferred. A seam, extending to 80,000 cubic *metres* had recently been exposed, and was about to be carried off, without any apprehension of the fire, which, in fact, has existed in these mines during the last four-and-twenty years, but the seat of whose action was at some distance from the mass in question, and was, besides, confined by important works of art. No danger seemed to present itself in that direction; yet an active an unceasing watch was maintained night and day. All possible precautions had thus been regularly taken. On the 15th of March last, a huge fall of earth, which no vigilance could foresee, suddenly occurred, throwing down the barriers established, and driving their guardians before it. The director of the mines immediately descended into the works, caused the safety-gates to be closed, and endeavoured to bar all access to the air. But the fire, bursting through every obstacle, spread with instantaneous and devouring force over the great coal seam, which was soon in full combustion. The civil and military authorities were immediately on the spot, and rivalled each other in zeal and activity. They were accompanied by the engineers of the roads and bridges, and those of the mines; who declared, that a great and continuous body of falling water was the only power capable of subduing the conflagration. But the river flowed thirty-eight metres beneath the coal-field. A minute survey of the ground was, however, made; and established the possibility of turning the course of a tributary stream, which flowed at a distance of 4300 metres. The work was instantly commenced; the ground-formations' for the bed of the deviation occupied forty-eight hours; and twice that interval of time sufficed to execute and arrange in their places certain wooden conduits, destined to traverse several intervening hollows. At length the waters so impatiently expected, arrived, pouring into the burning mine 2000 cubic metres of water per day. At the present moment, all the subterranean works are under water; and, since the commencement of this month, a system of irrigation has been established on the burning mass, which has produced the happiest effects. Hopes are entertained that, in time, not only will the immediate conflagration be extinguished, but that also which has been in operation for twenty-four years past.

New Mouth of the Vistula.—[*From a Correspondent of the " Morning Chronicle."*]—In consequence of the early breaking up of the ice in the Vistula, and the flood occasioned by the late heavy rains, the river was choked up a mile and a half above the city of Dantzic, whence it takes its course to the westward. The left bank of the river is here bounded by a dyke, which protects the fruitful low country behind it; the right bank is, however, without any such artificial protection, because its immediate neighbourhood consists of unfruitful sand land, and of a road of sand-hills or downs, for a distance of several German miles, which separate the river from the sea in such a decided manner, that it never appeared possible to any one, that from that side any danger was to be apprehended from the water in the Vistula. But it happened, on the night of the 31st of January, when it was expected that every

moment the water would run over the dykes on the left bank of the river, and produce a most dreadful inundation, that the stream, encumbered with heavy masses of ice, took its course over the right bank, and attained the sand-hills. These being from forty to sixty feet high, stopped the water, but the current undermined them just at the place where those hills merely consist of loose sand, and are the narrowest. As soon as they gave way, the accumulated mass of water and the heavy ice, found their way through this new opening with indescribable force, and made a broad and deep channel into the sea. To stop this new natural mouth is impossible, and, if it could be done, no one would feel inclined to do it. About thirty years ago, the plan was proposed by members of the Government, to form exactly the new mouth for the river, which has just been made by a natural cause. Thus a great expense has been saved, and a great benefit operated at the same time, by this occurrence. As regards the influence which this event may have on the communication of the town of Dantzic with the Port Fairwater, and also with Poland and the interior of the country, there is not the least ground to apprehend any interruption. We by no means lose the navigableness of the old Vistula, which, henceforward, as before, will bring the Polish barges and the timber transports to our town. Its depth is likewise sufficient in its whole length to bear vessels of the same magnitude as before. Neither does the occurrence make any change whatever in the communication of that town with the sea-port.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 20, D. Ziliani, Esq., on the Italian Literature of the 16th Century. Friday, May 22, C. Johnson, Esq., on City Gardening. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 21, C. H. Purday, Esq., on Music. At half-past eight.

Poplar Institution, East India Road.—Tuesday, May 19, Rev. W. Vidler, on Natural History. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society.—Wednesday, May 20, a Lecture on Chemistry. At eight o'clock.

⁂ Persons wishing to attend any of the Lectures before becoming members, may obtain an order by applying to Mr. Jeffs, 81, Shoreditch, H. Wiglesworth, 65, Tooley Street, or any of the Committee. The means which are proposed for carrying out the objects of the above Institution, are the following:—1st. A general meeting of the members will be held every Wednesday evening for the delivery of a lecture, the reading of a paper, or the opening of a question for discussion. In general, the lectures will be delivered, and the papers read by the members. It is considered advisable, that both political and religious subjects, as tending rather to irritate than convince, be entirely excluded, both from lectures and discussions. 2nd. A Library will be collected for the exclusive use of the members, as soon as the funds of the Society will permit. 3rd. Classes and sections will be formed for the study of Chemistry, Natural Philosophy, the Languages, Mathematics, Geology, Drawing, Vocal and Instrumental Music, &c., and Philosophical Apparatus provided for the use of the lecturers and members. The meetings for the present will be held at the Infant Schoolroom, 236, High Street, Shoreditch; but the Committee desire expressly to state, that they intend to remove, as soon as possible, to a more eligible situation. Members' Tickets, Prospectuses, with every information, may be obtained after any of the meetings of the Society, on application, by letter or otherwise, to Mr. Jeffs, or to Mr. H. Wiglesworth, 65, Tooley Street.

QUERIES.

A receipt for the best mode of cleaning paintings? B. R.

How to make pink saucers? X. Y.

If I take a lever 12 inches long, suspend one end, as in the safety-valve, and load the other end with 8 lbs., what weight will a point in the centre have to sustain, reckoning the weight of the lever as nothing? J. C.

How to make a good pastile, bottle lemonade, lemonade powders, ink, blacking, and bottle ginger-beer? J. W. K.

The best method for improving the colour of honey, and to set it firm in warm weather when thin? To take the colour out of cucumbers, and make them quite white? Z. O.

The most accurate and expeditious method of grinding and polishing lenses of all kinds, with directions for making the tools and machinery, and the best materials for grinding and polishing? S. H. T.

TO CORRESPONDENTS.

Q.—*The best way to clean dead gold articles is, to brush them with a fine brush (according to the delicacy of the object) with soap and hot water.*

J. C——y (Dungarvan).—*The solution of his problems may be found in any elementary work on mechanics. When a force acts obliquely on a straight lever, produce the line which represents the direction of that force, and draw a perpendicular to the fulcrum, or centre of motion; that line will be the length of effective leverage.*

Arthur Hodge.—*We decline answering any farther communications on the subject of his "improved flower-pots."*

J. S. *will find the receipt he requires in Vol. III., page* 270.

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 93, NEW SERIES. | SATURDAY, MAY 23, 1840. PRICE ONE PENNY. | No. 214, OLD SERIES.

WATER SEEN THROUGH A MICROSCOPE.

22

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

MICROSCOPICAL DISCOVERIES.

(See Engraving, front page.)

There are few human inventions which have revealed more of the remote secrets of nature than the microscope; and the attention which it now commands from the learned, as a means of philosophical research and analysis, combined with the great improvements in the construction of the instrument, which are from time to time achieved, lead us to expect that it is destined to unfold many leaves in the book of nature, which have remained hidden from man since the creation.

Microscopes originally consisted of a single lens, or sphere of glass, or a minute drop of some transparent liquid; then comes mighty science, and the compound microscope is invented; and now, by the aid of chemistry, the very elements are subdued, and a light equal to that of the sun, is artificially produced. The most interesting, and the most wonderful discovery of the microscope, is the existence of living organized beings, invisible to the naked eye; creatures so minute, as to be imperceptible, even when magnified a thousand fold; and yet, not only endowed with the power of motion, but provided with everything necessary for their convenience and enjoyment. The same power that poised the mighty planets in the firmament, has provided for all the wants of the minutest, invisible, and nameless things that people a drop of water. The engraving represents the actual appearance of a drop of stagnant water, seen through any powerful microscope. The favourite element of these extraordinary beings, is water contaminated with corrupted vegetable matter; and different kinds of plants produce different species of animalcules; so that their varieties are innumerable.

We have received a notice of a microscope constructed on a remarkably simple principle, and well adapted for the examination of minute objects.

" This useful and ingenious microscopic lens is the invention of Lord Stanhope; both ends are ground convex, the one next the eye rather more so than the other. It has many advantages over the common lens; for instance, the difficulty of holding the hand steady to the focus, and the loss of light and small field attendant on viewing with a high magnifying power, are here obviated; for, the length of the cylinder being the exact focus, the object has only to be placed upon the end that is ground less convex, or to be brought in contact with it; when the advantage of great magnifying power will be obtained, with a field of nearly five inches—equal to many of the compound microscopes.

The portability of this instrument, its low price, and the facility with which it can be used, must recommend it strongly to all who use microscopic lenses. With it may be viewed the animalcules in water, mites in cheese, eels in paste and vinegar, the perspiration, human hair, farina and leaves of flowers, the hairs of animals, the down of moths, &c.; and, if a single drop of the crystallization of salts be spread lightly over the end of the lens, and viewed without delay, the formation of the crystals will be beautifully apparent."

ON THE EDUCATION OF THE WORKING CLASSES.

[We have been favoured by our correspondent (Mr. Amer) with the following abstract of a lecture delivered, as he informs us, by Mr. Coombe. It is a subject which not only calls for the most serious consideration, but justice demands that every effort should be made to enable the working classes to participate, in some degree, in the advantages derived from machinery; it is an intricate problem, and certainly not practically solved by Mr. Coombe; but the mere mention of the subject, by attracting attention and eliciting suggestions, is a step towards its final accomplishment.]

The industrious classes constitute a vast majority of the population of Great Britain. The kind of education which they ought to receive, will depend on the objects which we assign to their lives. If they have been created merely to toil and pay taxes, to eat, sleep, and transmit existence to future generations, a limited education may suffice; but if they are born with the full faculties of moral, intellectual, and religious beings; if they are as capable, when instructed, of studying the works of God, of obeying his laws, and admiring his institutions, as any class of the community; in short, if they are rational beings, capable of all the duties, and susceptible of all the enjoyments which belong to the rational character, then no education is sufficient for them, which leaves any portion of their highest powers waste and unproductive. This is the light in which I regard them; and the grand question presents itself, What mode of life, and what kind of pursuits, are best adapted to the nature of man? In the present state of society, the industrious classes, or the great mass of the people, live in the habitual infringement of the most important laws of their nature. Life with them is

spent to so great an extent in labour, that their moral and intellectual powers are stinted of exercise and gratification; and hence their mental enjoyments are chiefly those afforded by the animal propensities; in other words, their existence is too little rational; they are rather organized machines, than moral and intellectual beings. The chief duty performed by their higher faculties is, not to afford predominant sources of enjoyment, but to communicate so much intelligence and honesty as to enable them to execute their labours skilfully and with fidelity. I speak of the great body of the labouring population; there are many individual exceptions who possess higher attainments; and I mean no disrespect even to this most deserving portion of society; on the contrary, I represent their condition in what appears to me to be a true light, only with a view to excite them to amend it.

The necessity of labour to the enjoyment of life, is imprinted in strong characters on the structure of man. The osseous, muscular, and nervous systems of the body, all require exercise as a condition of health; while the digestive and sanguiferous apparatus rapidly fall into disorder, if due exertion be neglected. Exercise of the body is labour; and labour, directed to a useful purpose, is as beneficial to the corporeal organs, and far more pleasing to the mind, than when undertaken for no end but the preservation of health. Commerce is rendered advantageous, because different climates yield different productions. Agriculture, manufactures, and commerce, therefore, are adapted to man's nature. Labour is beneficial to the whole human economy, and it is a mere delusion to regard it as in itself an evil; but the great principle is, that it must be moderate both in severity and duration, in order that men may enjoy, and not be oppressed by it. It may be objected, that a healthy and vigorous man is not oppressed by ten or twelve hours' labour a-day; and I grant that, if he be well fed, his physical strength may not be so much exhausted by this exertion as to cause him pain. But this is regarding him merely as a working animal. My proposition is, that after ten or twelve hours of muscular exertion a-day, continued for six days in the week, the labourer is not in a fit condition for that active exercise of his moral and intellectual faculties, which alone constitute him a rational being. The exercise of these powers depends on the condition of the brain and nervous system; and these are exhausted and deafened by too much muscular exertion. The fox-hunter and ploughman fall asleep when they sit within doors, and attempt to read or think. The truth of this proposition is demonstrable on physiological principles, and is supported by general experience. The first change, therefore, must be to limit the hours of labour, and to dedicate a portion of time daily to the exercise of the mental faculties. So far from this limitation being unattainable, it appears to me, that the progress of arts, sciences, and society is rapidly forcing its adoption. Ordinary observers appear to conceive man's chief end to be to manufacture hardware, broad cloth, and cotton goods, for the use of the whole world, and to store up wealth. They forget that the same impulse which inspires the British with so much ardour in manufacturing, will, sooner or later, inspire other nations also; and that, if all Europe should follow our example, and employ sufficient machinery, and a large proportion of their population in our branches of industry, which they are fast doing, the four quarters of the globe will at length be deluged with manufactured goods—only part of which will be required. When this state of things shall arrive—and in proportion as knowledge and civilization are diffused, it will approach—men will be compelled, by dire necessity, to abridge their toil, because excessive labour will not be remunerated. The admirable inventions, which are the boast and glory of civilized men, are believed by many persons to be at this moment adding to the misery and degradation of the people. Power-looms, steam-carriages, and steam-ships, it is asserted, have all hitherto operated directly in increasing the hours of exertion, and abridging the reward of the labourer. Can it be believed, that an almost creative power has been bestowed solely to increase the wretchedness of the many, and minister to the luxury of the few? Impossible. The destiny of society appears not yet to be divined. I hail them as the grand instruments of civilization, by giving leisure to the great mass of the people to cultivate and enjoy their moral and intellectual powers.

(*To be continued.*)

LATENT HEAT.

Heat is of two kinds, sensible and latent. Sensible heat is that which affects the thermometer or touch; and latent heat is that which does not. Large quantities of heat must enter into bodies and become latent, in order to enable them to pass from the solid to the fluid state, and from the

fluid to that of vapour. Thus, the quantity of heat necessary to convert any given quantity of ice into water, would raise the same weight of water to 140° Fahr.; but we find that the temperature of the water thus converted, does not increase until the whole of the ice is dissolved; therefore this heat must be concealed, kept hid, as it were, or, to use the proper term, latent; as it cannot be detected by the sense of touch, or by application of the thermometer.

According to Dr. Black, the latent heat of steam, at the boiling point, is 810°, but more correct experiments prove it to be 1000°; but it is inversely proportioned to the degree of pressure under which it is formed; that is, the latent heat is greatest where the pressure is least, and least where the pressure is greatest; and the sensible heat and latent heat added together, give the sum of the sensible heat and latent heat at any other temperature. The latent heat at the boiling point is 1000°; sensible heat, $212^\circ - 32 = 180 + 1000 = 1180$. This is the constant sum at any other temperature. Now steam, at the ordinary pressure of the locomotives, is from 40 lbs. to 60 lbs. upon the square inch; and, at that temperature, it will not scald close to the orifice of the valve, or within an inch or so (I have seen the experiment tried frequently by the engineers upon the railway); and, at the distance of three or four inches, we find it very hot, and the reason is this; the latent heat and sensible heat at this pressure are combined together in such proportions, that the latent heat destroys or overpowers the sensible heat; and the reason why it scalds at a short distance is, because the latent heat is set at liberty and flies off, and the sensible heat is left to exert its influence alone.

Whether it would scald at 80 lbs. or 100 lbs. upon the square inch or not, I cannot tell; but I think it would, as the sensible would be much increased, and the latent heat decreased.

BROOKS.

THE ROYAL GEORGE.

(From a Correspondent.)

COLONEL PASLEY began his proceedings for the removal of the wreck of the *Royal George* on the 1st of this month, but up to this day nothing very remarkable was effected. Two guns, the rudder, and a considerable quantity of timber, were recovered; but as these were merely those fragments of last year's work, which the inclemency of the season prevented the engineers from picking up, no serious measures were deemed necessary till the 15th.

At eight o'clock in the morning, the red flags at Spithead announced that a great explosion was to be attempted, and at eleven o'clock, one of those huge cylinders, which have already been described, and filled with 2116 lbs. of gunpowder, was lowered to the bottom. One of Colonel Pasley's divers (George Hall), who has acquired great expertness in these operations, descended his rope ladder a little in advance of the cylinder, and succeeded in fixing it securely to one of the lower gudgeons or braces on the rudder-post, within six or eight feet of the keel. The diver having remounted, and the vessels being withdrawn to a safe distance, the enormous charge was ignited by means of the voltaic apparatus. Within less than two seconds after the shock was felt, the sea rose over the spot to the height of about fifteen feet, or not quite half so high as it did on occasion of the great explosions last year, a difference ascribable, propably, to the cylinder on the present occasion having been placed under the hull, instead of alongside it. The commotion in the water, however, was so great, as to cause the lumps and lighters to pitch and roll at a great rate. The whole surface of the sea, for several hundred yards round, was presently covered with dead fish and small fragments of the cylinder. Amongst these, were innumerable tallow candles, and a mass of butter a foot and a half in length, evidently driven up from the purser's store-room.

As soon as the vast commotion in the water had subsided, and the boats had returned from the universal scramble for the candles and dead fish; the diver proceeded again to the bottom, and soon reported that the whole stern of the ship had been driven to pieces, and that, so far as he could ascertain, there was now a free and wide channel directly fore and aft the ship, from stem to stern, through which both the flood and ebb tides will rush, and thus the mud with which the hull of the *Royal George* has been silted for half-a-century will be washed out, and the way cleared for Colonel Pasley's farther operations. From the auspicious manner, indeed, in which he has commenced, we may safely predict his final success; and we confidently trust that, before the season closes, Spithead will be cleared of this grievous and long-standing drawback to its efficiency as a roadstead for line-of-battle ships.

LONDON JOURNEYMEN'S TRADES' HALL.

(REPORT.)

THE Provisional Committee deem it a duty they owe this Meeting, although an adjournment of the one held in this place on the 9th of March, to report to you the progress which has been made since they last had the pleasure of meeting the trades and operatives of London on this important subject.

The project for erecting a Trades' Hall by the united energies and subscription of the working men of the metropolis, is an Herculean office; and time and untiring perseverance in agitating the mass of mechanics will alone insure the prospect of success. Your Committee are proud to witness the activity and enthusiasm which prevail among the shareholders; and they entertain in their own minds the most confident expectations of realizing all the benefit and advantages of your undertaking.

In the Report which your Committee submitted to you on the 9th of March last, the applications for shares up to that period, were stated to be about 400. The enthusiastic reception which the project of a Trades' Hall received on that occasion, at the hands of a very crowded assembly, gave every reason to calculate on an accession of strength to its number. Arrangements were accordingly made for giving the utmost facility for the reception of the additional applications for shares which might be made. Two members of your Committee have been in attendance at the Trades' Hall Office, 16, Old Bailey. every evening up to the present time. Nearly 200 collecting-books have been distributed to the secretaries of trade societies and lodges, as far as it was practicable to communicate with them throughout the metropolis, as also to several of the shareholders; and although your Committee have not been favoured with any return officially of the number of applications contained in the majority of those books, they have learnt indirectly, that many of them contain several names; and, under all the circumstances of the case, your Committee feel warranted in calculating on having received up to this evening, applications for upwards of 1000 shares.

It is a source of peculiar pleasure to your Committee, to be able to communicate to you the spirited manner in which a number of the shareholders have already guaranteed the purchase of several hundred additional shares, so soon as 7500 shares shall have been taken up in this undertaking. Such a measure of imparting confidence and stability to its progress, it is anticipated, will receive the cordial support of the majority, if not all of the candidates for the Council, as it has already done that of your Committee. The success of a Trades' Hall is now in your hands; secure it to yourselves and your children, by an instantaneous and universal combination in its favour, and think that your duty remains undone, until you meet in the majesty of your thousands beneath its roof.

Your Committee have it in contemplation to recommend the adoption of some very energetic and immediate means to draw the attention of the London trades to the necessity of giving a decided support to the erection of a Central Trades' Hall, by investing a portion of their funds in the purchase of shares in this undertaking. Whether such means shall embrace district public meetings, or deputations, the Council, who are shortly to be elected, will be called upon to determine and carry out; in the meantime, every shareholder belonging to a trade society, is earnestly intreated to agitate this point immediately and constantly at their various meetings; and your Committee are not without an ardent hope, that in time your untiring exertions in its behalf in your respective trades, lodges, and workshops, will draw forth those large and important bodies of men to identify the moral and social welfare of their members with the speedy erection of a Trades' Hall.

It is highly encouraging to hear, that some of the trades are agitating the propriety of deserting the public house as inimical to the good conduct of their meetings, and prejudicial to the character of their members. An approximation so close to the real and fundamental objects of a Trades' Hall, will animate your Committee with the speedy prospect of the united support of such trades in securing the establishment of a building, where all may meet without reference to political or sectarian prejudices; and where the general convenience of the accommodation will produce a consolidation of the numerous lodges into which some are now divided, and produce a better and more unanimous administration of business.

Your Committee rejoice to learn, that the attention of the numerous lodges of the Friendly Society of Operative Carpenters has been seriously directed to the question of taking shares from their general fund; and it is a source of much gratification to your Committee to report, that so large and intelligent a body of men

have resolved on taking fifty shares in the undertaking now before you; in addition to which, the members of the Penny Fund connected with Lodge No. 13 of the same body, have also taken five shares. There is reason to augur, from this accession of collective strength, a great influx of energy and zeal in its behalf, which cannot be exercised in vain, when honestly directed to the welfare of the thousands who toil.

Your Committee have some reason to think, that the necessity and value of a Trades' Hall is forcing itself on the attention of a large and enthusiastic body of individuals, the advocates of total abstinence in London, who are pledged to the suppression of intemperance: a Trades' Hall aims at the same noble object, and a friendly understanding ought to exist between those who are identified in one common good: let that good, however, concentrate itself under the roof of a Trades' Hall, as the focus from whence the general promulgation of temperance shall spread far and wide among the labouring population of the country; for only in proportion as drunkenness, vice, and ignorance, are removed, will the moral and political character of the operatives be regenerated, and their welfare based on the permanent foundation of knowing and carefully preserving their position in society.

It is pleasing to find amidst the slow, but sure progress of this project, a gradual wish prevailing, in certain publications, to aid its promotion; these are mementos of the onward march of the principle of a moral and intellectual union of the working class; and your Committee, fully reconciled to the necessity of time and perseverance to consummate their anxious desires for the erection of a Trades' Hall, can look back on the past with feelings of satisfaction, and to the future with strong hopeful anticipations.

A few more days, and your Provisional Committee will no longer exist; they have gladly embraced the power vested in them by the 50th Law of Enrolment; and have accordingly convened a meeting of the shareholders to be held on Tuesday evening, the 26th of May, in the Aldersgate Street Temperance Chapel, for the purpose of proceeding to the popular election of a Council of Forty-five, and a General Secretary. And they deem it their duty, in taking leave of this meeting, to draw your attention to the list of candidates, who have been respectively proposed by shareholders for those offices in the following order.

Candidates for Council.

[Here follows a list of fifty-six candidates, chiefly working men.]

Your Committee have only to exhort their brother shareholders at the approaching election, to return such representatives as will "well and truly serve" the operatives of London, and the best interests of the Trades' Hall; let them be practical men—working men! who will rally round it as the day-star of your promised greatness; furnish them early with the means of erecting such a structure, and beneath its roof you will be able to demonstrate to the world the happy union of the intellectual, the social, and the political. Your Trades' Hall will be the great national school of the day, where operatives and their children shall be taught the best of all knowledge—the use and power of their intellects, the claims of citizenship, the extent and justice of their natural rights, and the duty of all to hold fast, and exercise such rights as are at present enjoyed, and to seek the immediate and legal restitution of all others, which may be still withheld from the industry of the empire.

[The following resolutions were unanimously agreed to; and though we differ from some of the speakers with regard to the best mode of improving the condition of *productives*, we were delighted to observe, that perfect order and good feeling prevailed throughout the evening, although the hall of the Institution was literally crammed.]

1. That it is the opinion of this meeting, that the working men of London, from their number, and the direct and indirect influence of their labour on the welfare of the country, ought to enjoy the utmost facility for assembling together on all matters of national and local importance; in order that the exercise of public opinion may be honestly preserved and freely used among them, as the wholesome safeguard of the rights of labour, and the general benefit of the empire.

2. That a Trades' Hall, in the centre of London, ought to supply a deficiency which is painfully felt to exist in the metropolis—an institution open to all classes, but more especially the operatives, without reference to political or sectarian prejudices, and in which public meetings of all kinds, and at all times, may be held at a very trifling cost.

3. That it is the opinion of this meeting, that the erection of a London Journeymen's Trades' Hall in a central situation, would at once present to the united trades of London the means of concentration, and promoting an easy and prompt com-

munication between them; while political associations, temperance and benefit societies, and all the various institutions which now abound, would, by meeting in such a building, give a moral, respectable, and commanding tone to their proceedings, and indicate the progress of intellect and influence among the working class.

4. That this meeting learns with delight, that some of the trades of London have already identified themselves with the principle of a Trades' Hall; and while it confidently relies on their support in carrying out the great objects of this undertaking, desires to appeal to the whole of the metropolitan trades, to consummate at once the success of the project, by immediately investing a portion of their respective funds in the purchase of shares.

5th Resolution proposed by individuals spontaneously in the meeting.

Thanks to Provisional Committee for their persevering exertions in forwarding the undertaking.

THE CHEMIST.

ON ALKALIES.

(Continued from page 14.)

Digitalia (Vegeto).—To obtain this alkali, M. Leroyer takes one livre of fox-glove, and treats it first with cold ether, and then with the same fluid heated in a close stove, in order that the temperature may be raised to a considerable degree. The tinctures obtained in this manner are (after being mixed and filtered) of a greenish-yellow colour; the residue, from their evaporation, being taken up by water, divides into two parts; one remains in solution, and the other is precipitated. Hydrate of protoxide of lead is then added to neutralise some free acid, which the solution contains. The portion thus treated with lead, is to be evaporated to dryness, and then dissolved in highly rectified ether; by which process the bitter principle of the fox-glove is obtained, disengaged from those matters with which it was contaminated. By evaporation, the solution yields a heavy brown substance, which restores very slowly the blue of reddened turnsol paper. This character, as well as its bitterness, approaches it to the alkalies, though its extreme deliquescence separates from them.

Emetina (Vegeto).—M. Collandor's process for obtaining pure emetina is as follows:—Mix about four ounces of the cutical part of ipecacuanha in powder, with about twenty-five ounces of water, acidulated with fifteen grains of sulphuric acid; boil the mixture, and then keep it a little below that point of heat for half-an-hour, stirring it constantly with a wooden spatula; then pour the whole into an earthen dish, presenting as great a surface as possible. This acidulated decoction is left to cool, and four ounces of lime in powder is then added; the whole is then dried in a stove at a temperature not exceeding 145° Fahr. This mass, which is composed of sulphate and gallate of lime, fatty and colouring matter, combined with an excess of lime, free emetina, fecula, and ligneous matter, is then pulverized; on submitting it to the action of alcohol, the emetina is dissolved, from which it may be obtained by evaporation. Pure emetina is white, and is not changed by the atmosphere. It is slightly soluble in cold water, more so in hot, very much so in ether and alcohol. It is very fusible, melting at 122° Fahr. It dissolves in all acids, diminishing, without extinguishing their acid properties; at the same time it forms with them salts that are readily crystallizable. According to the analysis of MM. Dumas and Pelletier, it is composed of

Carbon	64.37
Azote	4.00
Hydrogen	7.77
Oxygen	22.95
	99.09

Hyoscyamia (Vegeto).—This alkali was discovered by Brandes in the seeds of the black henbane; the tincture of which is to be mixed with a small quantity of lime, and the precipitate digested in dilute sulphuric acid. The solution containing sulphate of hyoscyamia is then decomposed by carbonate of soda; the precipitated hyoscyamia is then removed from the solution, and dried on blotting-paper. It is then dissolved in absolute alcohol, filtered through animal charcoal, and the solution evaporated, which yields it pure. Hyoscyamia is very poisonous, and of a bitter taste. It forms silky crystals, which are almost insoluble in water, but soluble in alcohol and ether. It is decomposed when heated with the fixed alkalies, and evolves ammonia.

Septimus Piesse.

MISCELLANEA.

The Skin of a Boa has been presented to the Museum of the Asiatic Society of Bengal, which measured twenty feet in length. When shot, the boa measured twenty-one feet. "It had swallowed a spotted deer, which was taken out of the inside, not too much decomposed for the spots in

the skin to be quite distinct. Where the deer was, the skin measured three feet, one inch across."

Feather Flowers.—At the exhibition of the Horticultural Society, last week, much interest was awakened by the beauty and truth of an imitation of a rose, constructed entirely of feathers, of their natural colour and shape, the work of Mrs. Randolph, of Bridge Street, Westminster, a self-taught proficient of her very beautiful art. A great variety of "flowers of all hue," manufactured, if we may use the word, by this lady, were exhibited at the last *soiree* of the Marquis of Northampton, and were much and generally admired.—*Athenæum.*

The Vial of Four Elements.—Take a vial six or seven inches long, and about three-quarters of an inch in diameter; in this vial put first, glass coarsely powdered; secondly, oil of tartar; thirdly, tincture of salt of tartar; and, lastly, distilled rock oil. The glass and the various liquors being of different densities, if you shake the vial, and then let it rest a few moments, the three liquors will entirely separate, and each assume its place; thus forming no indifferent resemblance of the four elements.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 27, D. Ziliani, Esq., on the Italian Literature of the 16th Century. Friday, May 29, G. H. Pell, Esq., on Fluctuations in the Quantity, and, consequently, in the Value of the Currency; on the Causes and Effects of such Fluctuations, and on the Means of Prevention. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 28, N. F. Zaba, Esq., on the Moral and Intellectual Powers of Woman, and the Influence she has exercised on the progress of Civilization in Europe and Asia. At half-past eight.

Poplar Institution, East India Road.—Tuesday, May 26, J. H. Elliott, Esq., on Physical Education. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, May 27, a Lecture on Astronomy. At eight o'clock.

QUERIES.

Whether the metal heads for weaving woollen, linen, and cotton fabrics, for which a patent was taken out a few years since, are answering, or in use? W. B.

How Manning's wooden houses for emigrants are constructed? I mean such a description as would enable a mechanic to construct one on the same principle.

BENJAMIN TONGUE.

ANSWERS TO QUERIES.

To make the best Blacking.—Take of ivory black, four ounces; coarse brown sugar, three ounces; sweet oil, a table-spoonful. Mix them gradually in a pint of cold small beer.

A good Tooth Powder.—Prepared chalk in powder, four ounces; powdered cuttle fish, two ounces; powdered orris root, two ounces. Mix.

Tincture for the Toothache.—Take of pellitory of Spain, two ounces (it is called "radix pyrethri" by druggists); spirits of wine, half-a-pint; water, half-a-pint. Steep the pellitory in the spirit and water for fourteen days, and then strain.

To make Pilul. Rhei. Comp.—Take of powdered rhubarb, one ounce; powdered aloes (socotrina), six drachms; powdered myrrh, four drachms; powdered Castile soap, one drachm; oil of carraway, half-a-drachm. Mix the powders together first, then add the oil, and beat it all up with treacle and water to the consistence of putty.

A. C. R.

TO CORRESPONDENTS.

Sigma *can obtain the back Numbers he wants at the publisher's.*

G. D. L.—*The first step in the study of mechanical science, is geometry. Simson's edition of* Euclid *we recommend as the best; but cheaper works, that would answer the purpose of a beginner, may be met with at second-hand shops. This is a very easy study, and scarcely requires any other teachers than books. After this, a little algebra will be required; and, as the student proceeds, his own wants will point out the different subjects it is necessary for him to study.*

J. Rothwell *wishes to know "Upon what principles the hydrometer and barometer are constructed? What causes the mercury to rise or fall in the barometer? Also, what causes the rising of the hydrometer in strong, or its sinking in weak liquid?" The mercury rises and falls in the barometer, because the pressure of the air varies; sometimes forcing up, and sustaining a column of thirty inches, and, at others, sustaining only twenty-eight inches. If a barometer be placed under the receiver of an air-pump, the mercury will fall as the air is exhausted; and if a perfect vacuum could be obtained, the mercury in the tube would subside to the level of that in the reservoir. The hydrometer does not rise in strong spirit; spirit is lighter than water, therefore the instrument sinks lower, the upward pressure of the liquid being less. This instrument indicates the specific gravity of the fluid in which it is immersed, and hence is inferred the proportions of water and spirit contained in a compound.*

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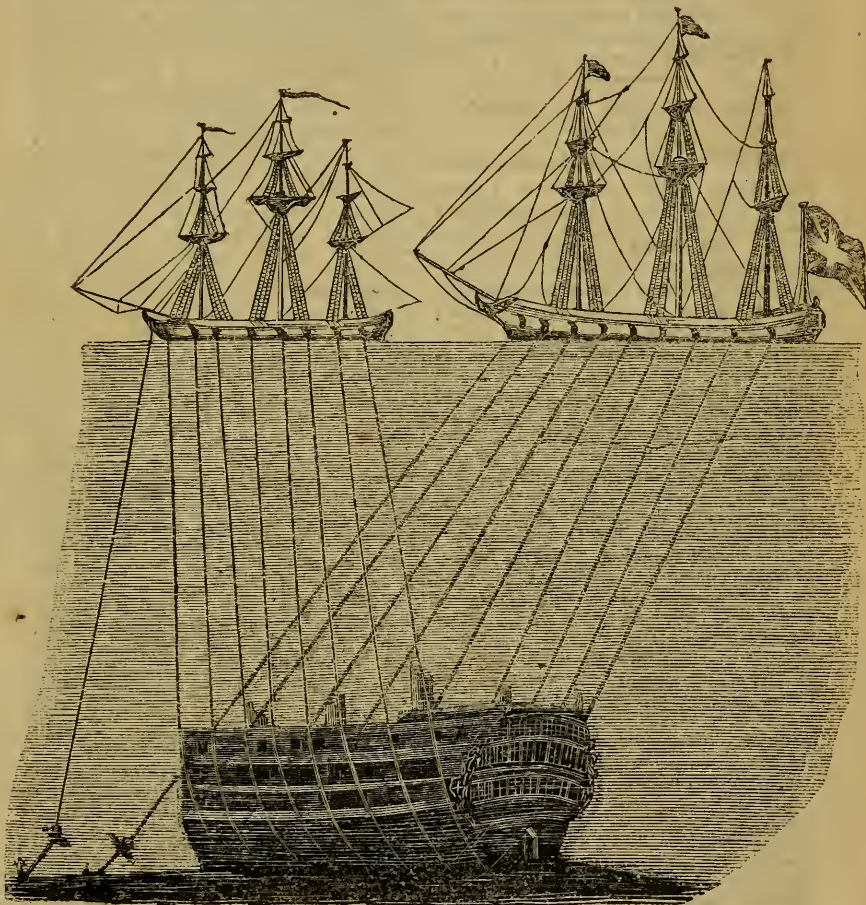
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 95, NEW SERIES. | SATURDAY, JUNE 6, 1840. PRICE ONE PENNY. | No. 216, OLD SERIES.

PLAN FOR RAISING THE ROYAL GEORGE



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

THE ROYAL GEORGE.

To the Editor of the Mechanic and Chemist.

(See Engraving, front page.)

Sir,—The destruction of the wreck of the *Royal George* at Spithead, by means of Col. Pasley's apparatus, having of late so much engrossed the public attention, I beg to forward you a representation of an attempt which was made to raise her soon after her sinking; an attempt, however, which proved unsuccessful, in consequence of the huge cable by which she was partially raised, giving way.

I am, Sir,
Yours respectfully,
A Constant Reader of the Mechanic and Chemist.
Portsmouth.

NEW DISCOVERY IN PHOTOGRAPHY.

To the Editor of the Mechanic and Chemist.

Sir,—From some experiments I have lately made with the Daguerreotype, I have good reason to believe I have discovered a method of fixing the pictures on the surface of the metal, so that it cannot be removed without considerable friction; and this by a process so simple, that I only wonder it has not been found out before. I only wait to make a few more experiments, to remove all doubts of the efficacy of my method. Now my reason for addressing you is, to know how I can secure the benefits resulting from my discovery to myself, having no means of procuring a patent; and, when even it is procured, it is not an effectual security to the patentee; and, if I were to make known my process, either publicly or privately, I feel assured I should be infallibly robbed of all the honour and profit resulting from it. I see examples of this daily. In England there is certainly no protection for the poor man.

I am acquainted with one or two processes, which would be of great service to the arts, but fear to make them known for the same reasons. I would, however, willingly do so, if I were certain of securing in any way even a moderate reward.

I am, Sir, your obedient servant,
A. Z.

[Our correspondent is, doubtless, aware, that a patent has been obtained in this country, for the Daguerre process. The French legislature considered the discovery too important to be withheld from the public by any personal patent or privilege, and, accordingly, granted a pension of 10,000 francs, or 400*l.* per annum, to M. Daguerre and his collaborator, M. Niepce (240*l.* to the former, and 160*l.* to the latter), upon the condition that the whole of the process should be described for the unrestricted benefit of the public. This is legislating for the nation, and rewarding, and, consequently, eliciting talent. Compare this with the unjust, narrow-minded, anti-Mecænatian conduct of the British Government. The same law which inflicts a penalty of from 300*l.* to 600*l.* upon every person convicted of labouring successfully for the public good, by inventing anything new and useful, is brought to bear against the people of this country, and deprives them of all participation in the benefit which the French Government have purchased, not for their countrymen alone, but for the whole scientific world. The Daguerreotype, though wonderfully accurate in its result, has the disadvantage of involving an expensive, tedious, and difficult process. If the atrocious patent law had not filched this invention from the people, many of our ingenious artists might, ere this, have so simplified the process, as to render it available to every traveller, and to every admirer of nature and art. But no; Mr. Jack Noakes has otherwise ordained. He takes his bags of gold to Messrs. Quirk, Gammon, and Snap; those gentlemen fee Mr. Attorney-general; he fees Mr. Tom Styles, and at last the patent is sealed, and it is declared in the name of the highest authority in the land, that Mr. Jack Noakes is the only person in the United Kingdom worthy of profiting by M. Daguerre's invention; and a sort of legal excommunication is fulminated against all those who may presume to invade the purchased honours of the great Mr. Noakes. It must be observed, that this is not bartering the rights of the people for 300*l.*; it is only putting in force an Act of Parliament which decrees, that, under such circumstances, any person possessing money may, by paying certain fees, cause the rights of the whole nation to be suspended in his favour. We implore our contemporaries to assist us in exposing and holding up to universal execration a law which encourages an intriguing speculator, and inflicts an insupportable penalty upon merit.

If "A. Z." should succeed in simplifying the Daguerre process, so that the instrument would be conveniently portable, and the operation of easy execution, he will possess a secret of great value; but, in the present state of the English law which, instead of protecting, absolutely

persecutes merit), he is not likely to obtain any of those benefits to which he is, in justice, entitled; but it will not be our fault, if things are not in a fair way of improvement before the end of next session of Parliament. We advise our correspondent to continue his experiments, and communicate them to no one; recollecting that the desired object is not so much the extreme precision and minuteness of detail exhibited in the Daguerreotype, as a cheaper and easier process, which will give a view with sufficient distinctness to show the shape and proportions of the chief objects in the image, so that a tolerably accurate drawing might be made from it. Any communication addressed to us with the word "confidential" written upon it, will be perfectly safe; but we by no means wish "A. Z." to divulge more than he may consider his own interest requires.]

TABLE BEDSTEAD.

To the Editor of the Mechanic and Chemist.

Sir,—The accompanying drawing is of a table bedstead of my own construction, which I have had in use in my kitchen for some time, and answers exceedingly well.

Fig. 1, *a a*, shows the flap up; the dotted lines, B B B, show the flap down; *c c*, two iron legs, fit into the frame to support flap when up; D, a sliding board, which pulls out to let the bedstead down; *e e*, box for bed and clothes.

Fig. 1.

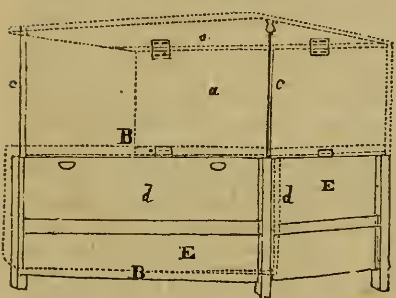


Fig. 2.

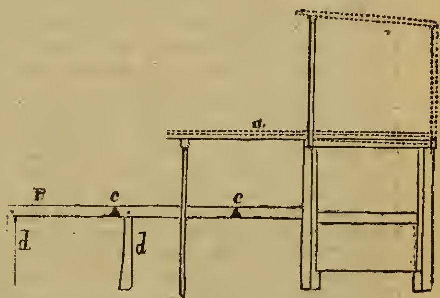


Fig. 2, *a*, shows the flap when used as a dining-table; B, the bedstead; *c c*, the joints; *d d*, swing legs. In putting up the bed, the clothes should be folded up; then turn up the bedstead, and put in the bed; then the sliding-board, and the rest of the clothes; let down the flap, and not any part of the bedstead or clothes is visible.

T. D. B——R.

BILL STICKING.

If we were to estimate the importance of this "profession" according to the pretensions of the artists engaged therein, it would, perhaps, rank higher than any other in the kingdom. The bill-sticker considers himself the protector of commerce, the patron of the drama, and fame's chosen trumpeter. At the time of our great national conscience market, called an election, he is a statesman; and he is so open to conviction, that his opinions are always identified, for the time being, with those of his employers. His warlike feats are attested by many a bleeding nose and sable eye; he is a chevallier *sans peur*, but not *sans tache*; for he is generally half smothered in paste, before he proceeds to pugilistic operations with his rival artist. A company was projected some time ago, under the title of "external decorators," pretending to establish a monopoly of the principal "boardings" (as they term the places where bills are allowed to be posted); but it was not carried into effect. This company *pour rire*, though a failure in itself, has suggested the idea that much advantage would be derived from a bill-posting establishment, possessing the power to secure the fulfilment of their engagements, and occupying the most important "boardings" of the metropolis. This company is now formed, and engagements are entered into, granting them the exclusive right to post bills

upon most of the conspicuous and desirable places about town; and they have erected boardings to a considerable height above the original palings. There appear to be three advantages held out by this company; first, a guarantee that all bills committed to their charge, shall be posted at each of the places agreed upon; second, that precautions will be taken to prevent their premature removal, or the posting of other bills over them; and, third, that no other bill-stickers will have the power of giving the same, or near so great publicity to their bills. That some reform is required, must be admitted by all who require the services of those tenacious gentlemen; in corroboration of which, we quote the following from "Grant's London Journal:" *—

"To meet with a bill-sticker in whom entire confidence may be reposed, is not an every-day event. If you charge them with not having done you justice in the posting of your bills, and point in proof to some conspicuous dead wall, which is not embellished with one of your announcements, they are always with their answer: —'Oh, that place was properly placarded, sir.' 'How happens it, then, that there are none to be seen now?' If the weather be warm, they will tell you the heat has torn them down; if it be wet, the rain has done the work of mischief. If the weather be neither warm nor wet, 'Some other "fellow of the trade" has covered them over with his stupid old bills;' with other similar excuses.

Bill-stickers have a quick eye to all professional matters. They can anticipate, by a sort of intuition, when a shop is about to be shut up, a house to be closed previously to being pulled down, or a wooden erection to be made; and before twenty-four hours have elapsed, they will cover every inch of the space with bills of all sorts, and printed on paper of all colours.

Bill-stickers are a fraternity with whom society are at eternal war. Denunciations and threats levelled at them, meet the eye everywhere. 'Bill-stickers, beware!' is a caution to the brotherhood, which is to be seen in all parts of the metropolis. When everybody's hand is thus raised against them, it ought to make them more united and friendly among themselves. We shall expect to hear, some of these days, that a sense of reciprocal interest has induced them to give up their squabbles and scuffles, and to form themselves into a sort of mutual protection society."

* "Grant's London Journal" is a highly instructive miscellany, on the plan of the "Edinburgh Journal. The last-mentioned publication was one of the earliest in preparing the way for cheap and useful literature, and is entitled to much praise. The more extensive sources of information, and valuable original matter which distinguish the "London Journal," render it equal to any work of the kind now published."

MASTER BOOT AND SHOEMAKERS' PROVIDENT AND BENEVOLENT INSTITUTION.

There is no safer speculation than subscribing to a mutual benevolent institution like the present; for if you prosper, you cannot feel the want of the money you have subscribed, and you will have merited the esteem of your fellow-tradesmen, and, which is of still greater value, your own; if, on the contrary, misfortunes should encompass you, and you should, in your turn, need a helping hand, your former bounties will be returned tenfold; not in the humiliating form of cold misgiving charity, but as a right you claim to that relief which, in happier days, you did not deny to others. A dinner took place on Wednesday, 27th inst., at the Crown and Anchor; it was very numerously and, we need not say, respectably attended. About 130*l.* were collected, and several annual subscribers added to the list. If the advice of a disinterested friend, who is not a stranger to the world, or to human nature, may be esteemed of any value, we most earnestly recommend every man connected with the boot and shoe trade—and they are very numerous—to contribute towards the support of this excellent Institution. The following is an extract from the Report of the Committee:—

"The Committee of the Master Boot and Shoemakers' Provident and Benevolent Institution hail the return of another period, when they are called upon, by the rules of the Society, to lay before the subscribers a statement of its affairs.

At each preceding anniversary, it has been their pleasing occupation to relate the steady progress of the Institution; and thankful are they, on this occasion, to make known that it still advances in numbers and respectability.

Your Committee feel assured it will be matter of congratulation for you to hear, that the conflicting opinions which invariably met their earlier efforts, are fast wearing away; even now the Institution ranks among its supporters those who are occupied in every branch of the trade; thus presenting, in miniature, that which they believe will, ere long, be seen in all its fulness—viz., a body of men, engaged in

the same pursuits of life, uniting hand and heart to alleviate the sufferings of those among them, whom Providence may ordain to be less prosperous than the rest.

During the past year, there has been an addition of fifty-three donors and subscribers, making a total of 520. By the cash account about to be submitted to you, it will be seen that the sum of 550*l.* has been invested; one-half of which is added to the building and endowment fund, the remainder to the fund for relieving those whom, ere long, you will be called upon to elect as recipients of your bounty; thus, towards the first great object, we have already the sum of 1631*l.* 17*s.* 10½*d.*, and for the other, 275*l.* 13*s.* 8½*d.*

These brief statements, your Committee trust, are enough to show they have not been unmindful of the trust committed to them. Far, however, from taking credit to themselves for all that has been done, they would rather express their sense of the valuable aid you have rendered in carrying out their plans, and in encouraging themselves and you by a retrospect of the past, would urge each to look at the great work to be accomplished. It is, indeed, gratifying, when we glance at the first printed Report in 1837, wherein is stated, that 486*l.* had been funded, to find on this night that sum augmented to 1917*l.* 5*s.* 2*d.*; yet if we take another view, and compare our 520 subscribers with the 2000 persons who compose the trade in London and its vicinity, to say nothing of that vast number throughout the country (who, by subscribing to the Institution, be it remembered, are equally eligible to become candidates for its benefits), we shall soon perceive that, far from resting on past achievements, our motto must be, as it then was, 'perseverance.'

Your Committee would remind you, that the period is not far distant, when those who were connected with the Institution from its commencement, will be so far admissible as candidates for relief. In all probability the widow and orphan will first seek your aid; and can there be objects presented to your sympathy, whom you would more willingly relieve? O, it is cheering in the midst of the difficulties which beset us in our good cause, to remember, these are they we seek to succour!

In conclusion, your Committee would express their earnest desire, that none here present may ever need the assistance towards which they are contributing, knowing that it is ever 'more blessed to give than to receive.'"

LONDON JOURNEYMENS' TRADES' HALL.

Report of the Provisional Committee submitted at a Special Meeting of the Shareholders on Tuesday, 26th May, 1840, in the Temperance Chapel, Aldersgate Street.

The peculiar and important object for which the shareholders are assembled on the present occasion, dictates to the Provisional Committee, that they owe an imperative duty at the moment of their retirement from office—to submit an unreserved statement of their proceedings up to the present time, in the promotion of the erection of a Trades' Hall, and their opinion of its present and future prospects.

The agitation of a proposed Trades' Hall, which has led to the formation of your present undertaking, was originally commenced by the circulation of some small and general prospectuses among a few individuals, chiefly belonging to the book-binding trade; by whom it was so well received, that a preliminary meeting was convened by circular, and by an advertisement in the *Charter* newspaper, and the same was held on Monday evening, 11th July, 1839, in Providence Hall, Finsbury Square; at such meeting your Provisional Committee were appointed, with power to add to their number.

Their first business was, to locate themselves in as central a situation as possible, for giving effect to their proceedings; a large room was engaged at the Suffolk Coffee-house, 16, Old Bailey, for their weekly meetings, at an expense of 2*s.* per night. A spirited address was at once drawn up, and 500 copies printed for distribution to the trades of London, as far as it was possible to get at their places of meeting; the appointment of delegates from each to meet and confer with your Committee, was strongly urged in these addresses; and on the 16th of August and subsequent meetings, delegates from numerous trades' lodges and societies, attended, until the plans and intended operations of the undertaking had been so far matured, as to enable them to report to their respective bodies the information which they were appointed to collect. From this union of delegates with your Provisional Committee, another prospectus, in a pamphlet form, was drawn up, and 1000 copies circulated among the trades of the metropolis and the public generally. The design, object, and constitution of the Trades' Hall, were severally elucidated in this publication, and the

principal fundamental features of the subsequent laws of enrolment were delineated, and very generally approved. The amount of capital required was, on the rude calculation of a respectable architect, fixed at 15,000*l.*, being an estimate of 10,000*l.* for the building of the Hall, and the remaining 5000*l.* for the purchase of the ground and incidental expenses.

About the same period, your Committee and other shareholders furnished themselves with fifty collecting-books, which were found extremely useful in securing the names of parties who would otherwise have shrunk from the necessity of coming to the Trades' Hall Office to register their names. These books were at once rendered subservient to the collection of the deposits on shares, which were accordingly commenced being received in October; and your Committee very early took the precaution of appointing (in the spirit of your proposed laws, which were not then published) a Finance Committee of three from their number, in whose hands, from time to time, the money which has accumulated after the payment of the necessary bills and rent, has been deposited in nearly equal proportions. This provision was rendered necessary in the uncertainty of success, to guarantee, as much as possible, against anything like an attempt at imposition; more especially as no amount was received at any one time, sufficiently large to commence an account with Messrs. Prescott, Grote, and Co., who very readily consented to become the Trades' Hall bankers, when their services should be required in that capacity. The payment of deposits has never been particularly pressed, so long as sufficient finances have come in to meet the current expenses. The value of collecting-books has been felt on all hands, and they have consequently been widely circulated—there being at this moment about 170 in the hands of shareholders, secretaries of trade societies, and others who are friendly to your project.

The increasing demand for a code of laws for the government of the undertaking, led to the appointment of a sub-committee in November, for the compilation of so important a document; the result of their labours is in your hands, in the printed laws with which each shareholder is furnished on registration. The enrolment of those laws was effected in December, and 1000 copies being printed, their general distribution took place at the commencement of the present year; abstracts of them have been extensively promulgated among trades' unions, lodges, and all public meetings where their circulation was at all likely to promote the success of your undertaking; in this manner 10,000 of these abstracts have found their way among the public.

The concluding proceedings of your Committee have been the two public meetings on the 9th March and 11th May, in the Mechanics' Institution, Southampton Buildings, Holborn. The effect of those meetings is very generally known; and it is sufficient to state, that they were, on both occasions, well attended, and have very manifestly created a spirit of inquiry as to the objects and advantages of a Trades' Hall.

Thus far we have detailed our proceedings, to give effect to the London Trades' Hall, in the success of which, your Provisional Committee are most deeply interested; whether the measures adopted by them shall receive your approbation or not, they have not been adopted and persevered in, without mature reflection as to their necessity and practicability.

What is now the present position of your important undertaking? 1050 shares are already applied for, while numerous collecting-books, containing the names of persons requiring shares, have not yet been returned to your Committee. The number of persons holding shares and actually registered in your share-books, is 604, including the different trades. Deposits have been received on 702 shares, and the remainder of the shares being more or less introduced into the share-books by registered shareholders, give a guarantee for the responsibility of the individual holders.

Your Provisional Committee dwell with much pleasure on the gratifying fact, that a spirit of enthusiasm prevails among the shareholders in behalf of your undertaking, which betokens, in their opinion, its ultimate success; and at this early stage of your existence, your Committee have received the promises of many of your shareholders to take additional shares, so soon as 7500 are registered. In this feeling, which is likely to be very generally participated in by the shareholders, your Committee gladly identify themselves, from a conviction that the progress of the London Journeymen's Trades' Hall is sure and certain.

The support of your several trades, individually and collectively, forms a most important principle to be aimed at; designed as your project is, peculiarly to suit the convenience of these large bodies of operatives, they must be early and effectually moved to recognize its claim on their prompt adherence. It is the anxious

wish of your Provisional Committee, to impress on the attention of their brother shareholders, the urgent necessity of using their individual exertions in their trades to accelerate this successful step, which would at once place the success of a Trades' Hall on the high ground of certainty. It is pleasing to know, that the agitation of its merits is going on in various quarters, and, in several trades, their influence and co-operation is anxiously looked for.

The Finance Committee will submit their report of receipts and expenditure as audited by three shareholders, who have not been connected with the Provisional Committee. The most rigid regard to economy has been scrupulously observed; and it will be seen, on reference to the auditor's balance sheet, that the expenses entirely consist of rent of office, expenses of two public meetings, printing, and stationery.

In conclusion, your Provisional Committee feel no hesitation in declaring themselves satisfied with the progress of your undertaking, in the few months that it has been before the public. However great may have been your exertions in common with themselves, to diffuse a knowledge of its utility and existence, it is still a fact (which ought to stimulate to greater exertion on the part of its friends and admirers), that, among our own class, are numbers still to be found, to whom the name of a Trades' Hall is wrapped in obscurity; of its design they are lamentably ignorant, and of its benefits to themselves and society at large, they are, consequently, strangers. These at present, therefore, can render us no efficient aid; they are obstacles in your path: let it be our duty to press forward and surmount every difficulty. The beams of intelligence will in time illuminate these dark spots in our passage, and create for us active friends where all is now lethargy and prejudice.

We leave our posts in your hands—we retire from onerous duties with a firm conviction that we have wished for the best, and aimed at the best; and, having done so, we leave to our successors, whom you may appoint this evening, the consummation of our labours and desires. We look for great things: the number, influence, and power of our class, warrant your Provisional Committee to expect them. Let the working men of London rally round themselves with the beacon of united intelligence in their centre, and the fiat of their wisdom will at once call into existence the great shield of their order—the tower of their intellect—the pride of the metropolis—the monument of labour—the heir-loom of industry—THE LONDON TRADES' HALL!

THE CHEMIST.

ON ALKALIES.

(Continued from page 31.)

JERVINE (Vegeto).—An alkaline base, which is obtained, by a complicated process, from the roots of the white helebore, in which it exists, along with veratia. It is closely allied, if not identical with sabadilline. It forms insoluble salts with sulphuric, hydrochloric, and nitric acids, and soluble salts with acetic and phosphoric acids. They are all decomposed by boiling with carbonates of the fixed alkalies.

Lime (Earthy).—Of all the alkalies, this one is of the greatest importance in the arts and manufactures. The most extensive employment of lime is in agriculture; it is also used in a multitude of preparations subservient to the arts—for clarifying the juice of the sugar-cane and beetroot; for purifying coal gas; for rendering potash and soda caustic in the soap manufactories; for the bleaching of linen and cotton; for clearing hides of their hair in tanneries; for extracting the pure volatile alkali from muriate and sulphate of ammonia; for mortar cements, and as a flux by iron-founders, &c. Lime is never found native (that is, in its pure state), but always in a state of combination, generally with an acid, and most copiously with carbonic acid—as in chalk, marble, and limestone, which are all carbonates of lime in various states of aggregation. Lime is extremely caustic: if water be sprinkled on it, great heat* is produced, and the water unites with it, forming a hydrate of lime. It is partially soluble in water, with this singular condition, that it is more so in *cold* than in *hot*; the solution, which is called lime-water, possesses alkaline qualities. A striking experiment may be performed with this solution:—A small quantity being poured into a wine-glass, blow through the liquid with a piece of tube; after a minute or so, this *transparent* and colourless liquid becomes an *opaque* milky one. In this experiment, the carbonic acid of the breath, in passing through the

* The heat arising in this case, and when water is poured on baryta, fused potassa, &c., is caused by the latent heat of the water being given out on its becoming solid by its union with lime, &c.

iquid, combines with the lime, and forms carbonate of lime or chalk, which is insoluble in water. A solution of muriate of lime mixed with alcohol, tinges the flame of the spirit of a brick-red colour.

Lime was thought to be an elementary or simple substance, until it was decomposed by Sir H. Davy, who found it to consist of oxygen and a metallic base, which he denominated calcium. Oxide of calcium or lime, consists, according to his analysis, of

Calcium	72.8
Oxygen	27.2
	100.0

Lithia (Earthy).—Is an alkaline earth, discovered, not many years ago, in a mineral called petatite and triphaur, found in a mine at Uto, in Sweden. The following is M. Aywedson's (the discoverer) process for obtaining it from the former mineral:—Having reduced the mineral to a fine powder, it is to be fused with half its weight of potassa. The fused mass is then to be dissolved in hydrochloric acid, filtered and evaporated to dryness. It is then to be digested in alcohol, which dissolves the chloride of lithium; by a second solution and evaporation, it is obtained pure. Its aqueous solution has then to be digested with carbonate of silver, by which a carbonate of lithia is formed, which is to be decomposed by lime. Like other alkaline carbonates, lithia is white, very caustic, has a sharp burning taste, and destroys the cuticle of the tongue. Like potassa, it is soluble in water, and slightly so in alcohol. The flame of alcohol holding chloride of lithium in solution, burns with a purple colour. Lithia is most remarkable for its power of acting upon, and corroding platinum. When the hydrate of lithia is submitted to the action of the Voltaic pile, it is decomposed; a white, brilliant, and highly combustible metal is separated at the negative pile, and oxygen at the positive. Lithia is composed, according to Gmelin, of

Lithium	50
Oxygen	50
	100

This alkali is distinguished from others, by Berzelius, in the following manner:—By the fusibility of its salts; by the liquefaction of the carbonate at the moment it is heated to redness; by its great power of saturating acids.

SEPTIMUS PIESSE.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, June 11, Harman Lewis, Esq., B.A., on German Silver. At half-past eight.

Poplar Institution, East India Road.—Tuesday, June 9, T. E. Bowkett, Esq., on Vitality. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, June 10, a Lecture on Mechanics. At eight o'clock.

QUERIES.

How to prepare phosphuretted ether?

E. J. & Co.

The best method of producing the dead colour on gold and gilt articles? G. M.

TO CORRESPONDENTS.

J. B.—*The machine he describes is merely a syphon; the water can never flow out of the shorter arm, whether the tube be capillary, or of large dimensions. Any porous substance will form a capillary syphon; a piece of blotting paper, or pack-thread, placed with one end in a cup of water, and the other hanging outside, will cause all the water in the cup to pass through, and drop off at the lower end of the syphon; but if that end be no lower than the surface of the water in the cup, the water will not flow; and if a drop be hanging to it, instead of accumulating, it will be absorbed, and conveyed into the cup; the inner arm being the longest. This is exactly the case in "J. B's." machine.*

Epictetus.—*The process of photography is fully described in No. 43, N.S., of the "Mechanic." To prevent the deterioration of the drawings by exposure or contact, it is recommended by M. Dumas to pour upon the plates a boiling solution of one part of dextrine in five parts of water, which deposits a thin coat of varnish, sufficient to effect the desired object.*

John Osbaldeston *would oblige us by sending either an abstract of his specification, or the date of the sealing of the patent granted to him for his metal healds. We have received favourable reports from productives who have witnessed their operation, and shall be happy to promote their adoption, by publishing a description and, if necessary, an engraving of them.*

A. Z.—*We feel deeply interested in the subject of his communications. His letter on the new process of gilding, we think, might be published without any prejudice to his future views; and, if he will inform us of his intention in that respect, it shall appear next week.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

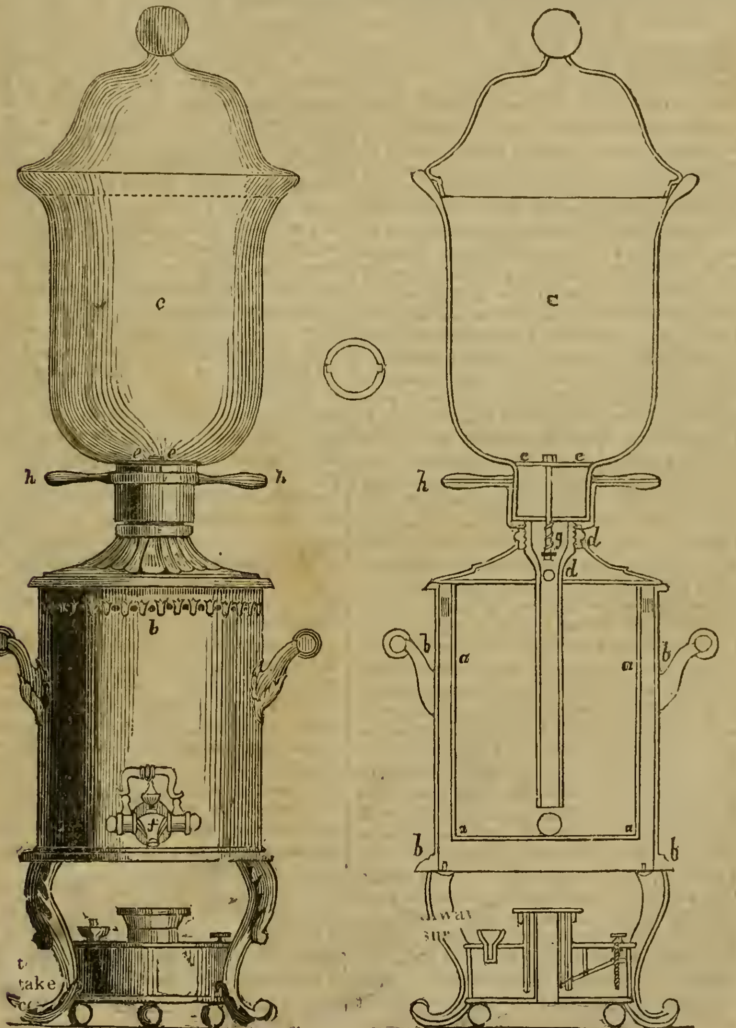
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 97, NEW SERIES. | SATURDAY, JUNE 20, 1840. PRICE ONE PENNY. | No. 218, OLD SERIES.

VARDY AND PLATOW'S PATENT APPARATUS FOR MAKING COFFEE AND OTHER DECOCTIONS.



Vol. VI.—No. 8.] City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

VARDY AND PLATOW'S PATENT APPARATUS FOR MAKING COFFEE AND OTHER DECOCTIONS.

The drawing (see front page) represents an apparatus constructed according to the invention — fig. 1, being an external view, and fig. 2, a section of a coffee-pot or vessel for making extracts; *a* being a cylindrical vessel, which is placed within the outer case, *b*, the object of the outer case being to receive a spirit-lamp in order to heat the vessel, *a*; but it will be evident that the vessel, *a*, may be heated in any other way, but the arrangement shown is convenient, where it is intended to stand on a table; *c* is an upper vessel, which has a descending tube, *d*, passing into the vessel, *a*; and the vessel, *c*, is affixed to the vessel, *a*, by means of a screw, or other means which will be convenient for readily separating the vessels, *a* and *c*, at the point, *d*. At the upper part of the tube, *d*, there is a bridge to receive a screw, by which the perforated plate is fastened; *e* is a perforated plate at the lower part of the vessel, *c*; *f* is a small hole, through the upper part of the tube, *d*; the object of this hole is, to allow of the passage of the air from out of the vessels, *a*, up into the vessel, *c*; otherwise the air expanding would force the water into the vessel, *c*, before it boiled; and we would remark, that the construction of the means of permitting the air to escape may be varied, provided the mode resorted to will admit of the passing off of the heated air, and yet not allow of the steam flowing freely off when the air has been driven off. It should, however, be understood, that this hole is small, so as to prevent the steam, as quickly as it is generated, from passing off in that direction; hence the pressure of the steam, when the water boils, causes the water in the vessel, *a*, to rise up the tube into the vessel, *c*, and mix with the coffee, tea, or other matter contained therein, and thus extract matter therefrom; and so soon as the heat is removed, a vacuum will be produced in the vessel, *a*, and the pressure of the atmosphere will cause the liquor to be filtered through the perforated plate; and the female screw is formed with a vertical groove, which will allow of the air passing out from the vessel, *a*, when water is running into the vessel, *a*, from the vessel, *c*; but when the screws of the vessels, *a* and *c*, are screwed tightly together, the [illegible] washer, placed at the joint, will keep [illegible] parts air-tight; *g* is a spring made of brass, by which, in the event of the filter, *e*, being stopped, the pressure of steam would [illegible] the filter and prevent accident; *h* is the handle to turn the upper vessel, in order to allow the air to escape when the water is being filled into the vessel, *a*, from the vessel, *c*, into which the proper quantity is first placed.

Having thus explained the mechanical arrangements of parts, we will describe the mode of using the same. A quantity of water, according to the quantity of extract of coffee required to be made, is to be put into the vessel, *c*, which vessel we generally make of glass; but it may be of other suitable material. The upper part or vessel, *c*, is then to be slightly unscrewed, and the water in *c* will pass into the vessel, *a*. When the vessels, *a* and *c*, are to be screwed tightly together, a quantity of ground coffee, or tea, or other matter, according to the strength of extract desired to be obtained, is to be put into the vessel, *c*, on to the perforated plate *e*. The spirit-lamp, or other means of heating, being placed under the vessel, *a*, or on that vessel being otherwise heated; steam is generated in such manner as to produce pressure on the inside of the vessel, *a*, which will cause the boiling water to rush up through the pipe or tube, *d*, through the perforated plate, or other filtering or straining medium, *e*, and mix with the coffee or other matter, and partly fill the vessel, *c*. The spirit-lamp is then to be removed, or the vessel, *a*, to be removed, from the source of heat; when heated by other means, the steam within the vessel, *a*, will quickly condense, and a partial vacuum will be obtained in the vessel, *a*, and the outer atmosphere, pressing towards such vacuum, will cause the extract in the vessel *c*, to be quickly filtered or strained through the plate, *e*, into the vessel, *a*, when the extract of coffee, or of the other matter, will be ready to be drawn off by the cock or tap, *f*.

Having thus explained the nature of the invention, and the manner of using the same, we would remark, that the shapes of the vessels, *a* and *c*, may be varied according to taste, and the filtering or straining material may be also varied. But what we claim is, first, the mode of combining the vessels, *a* and *c*, with the tube, *d*, and its perforation or outlet, *f*, as above described; and the mode of affixing the filtering surface or plate, *c*, by a screw, as above described.

Secondly, we claim the mode of combining the vessels, *a* and *c*, by screws, having a vertical groove, and employing a felt-washer to the joint as above described.—In witness whereof, &c.

NEW MODE OF GILDING.—IMPORTANT DISCOVERY.

We are authorised by the inventer to publish the following, and are promised a more detailed account of the process. Any one wishing for farther instructions on the subject, may obtain them for a moderate remuneration, by addressing a letter to the inventer, to be left at our office.

To the Editor of the Mechanic and Chemist.

Sir,—You have, doubtless, received my last communication respecting a method of fixing the Daguerreotype upon the metallic plates; and my reason for addressing you now is, in consequence of having seen this day a communication of a Frenchman respecting a process of gilding metals without the aid of mercury—viz., by voltaic electricity. Now as soon as Mr. Spencer made known his process of precipitating voltaic copper, and thereby procuring copies of engraved plates, a thought struck me directly, that gold might be precipitated in the same way, and thus employed for the purposes of gilding other metals; with this idea, I took a small plate of silver, and connected to it a very small copper wire, to the other end of which I fastened a piece of zinc, and covered it with a membrane. This little galvanic battery I plunged into a solution of nitro-muriate of gold, prepared for the purpose; and, on withdrawing it, I found, as I had fully anticipated, that the silver plate was beautifully covered with gold. Having, therefore, established the fact of gilding silver, I tried other metals, and found I could deposit it on several. My next step was, to see if this deposit adhered sufficiently; for this purpose I rubbed it with great force upon a piece of woollen, and found it still remained firmly fixed. I then submitted it to the process of burnishing, and found, to my great amazement and joy, that it stood this process also. Other occupations having prevented me carrying out the project farther, I left it in that state; but had I, Mr. Editor, been a rich man, I certainly should have patented my discovery directly; and the reason of my not making it known was, because I felt assured I should have been robbed of all the profit and honour resulting from it. But I can, if it be necessary, bring forward incontestable proof of priority of invention, and of the facts before stated; therefore I wish to know, whether anyone can now legally take out a patent for this process in this country, and if there remains any possibility of my securing any advantages from it myself; and I should like to know your opinion upon this subject, and what steps you would advise me to take.

I know several purposes to which this process might be applied, and feel persuaded that it will cause a complete revolution in the art of gilding.

I anticipate the same fate will attend my method of fixing the Daguerreotype; and if I cannot have the pecuniary advantages of this discovery, I should like, at least, to have a little of the honour. I am half disposed, therefore, to communicate it, but will first take your advice on the subject; and do not publish this, if you deem it not advisable.

I remain your obedient servant,

W. H. Hewett.

May 29th, 1840.

STEAM NAVIGATION.

(From the "Companion to the Almanac.")

In the *Great Western* and *British Queen*, the steam is used expansively; that is, the supply from the boilers to the cylinders is cut off before the piston has fully performed its downward and upward movements. This is by no means a new arrangement, but its application to marine engines is believed to be now first made in English vessels. The object is economy in the use of steam; and the mode in which this advantage is gained, will be understood from the following explanation:—The movement of the piston within the cylinder, from which the power of the engine is derived, is secured in what are called low-pressure engines, by the production of a vacuum on each side, alternately, of the piston; while a pressure equal to the ordinary weight of the atmosphere, or about fifteen pounds on each square inch, is preserved by means of the steam admitted to the other side of the piston. In high-pressure engines, the power is gained by the elastic force of steam, in a state of compression, acting against the ordinary pressure of the atmosphere upon each side of the piston alternately; while the steam previously admitted to the other side of the piston, and which has performed its office of driving the piston to the top or bottom of the cylinder, is allowed to pass freely from the cylinder through an eduction valve. Marine engines, although in this country they always bear the character of low-pressure engines, are, in fact, a combination of both high and low pressure. The steam employed has an elastic force, somewhat but not much greater than that of the atmosphere, and acts on one side of the pis-

ton through its efforts to expand itself; while, on the other side, a vacuum is produced by the condensation of steam which has already performed its functions. The elastic force of the steam used in our marine engines is never great, and, without the aid of the vacuum, would be of but little effect in giving motion to the machinery; but it must be evident that, whatever may be the amount of that elastic force, it will act as an auxiliary to the power gained by means of the vacuum. Let us, in order to explain the advantage of working steam expansively, assume that it is admitted to the cylinder from the boiler, with an expansive force of thirty pounds on each square inch of surface. Such steam, when admitted into a space which allows of such an expansion, will enlarge itself to double its original volume, and will then have a force equal to the ordinary weight or pressure of the atmosphere. If, then, steam of thirty pounds' pressure be admitted within the cylinder, and the supply be stopped when the piston has performed half its course, the effect will be to exert a force during that half equal to its elastic power of thirty pounds, and then to exert a progressively decreasing force through its tendency to expand itself—until at the completion of the stroke, the volume of the steam will have been doubled, and its force thereby diminished to the ordinary pressure of the atmosphere. It must be understood that these numbers and proportions are used merely for exemplification; the steam is not often used at so high a density as two atmospheres (30 lbs. to the inch); nor is the supply to the cylinder always cut off at half the stroke, but sometimes at two-thirds or three-quarters; thus allowing the steam to expand through the remaining one-third or one-fourth only of the course of the piston. It will be evident, however, that by this means a considerable economy is produced in the quantity of steam expended, and that the gain will be equal to the power exerted by the steam admitted to the cylinder during the time in which it is expanding its volume, *minus* the cost of the greater weight of fuel required for generating steam of high elasticity, which increase bears only a small proportion to the power which is by such means accumulated. In the *Great Western*, the arrangement of the valves is such, that the supply of steam to the cylinders can be cut off at any part of the stroke, or the steam can be admitted during the whole of the stroke, at the pleasure of the engineer, and according to the varying conditions of the wind and weather.

COMBUSTION.

To the Editor of the Mechanic and Chemist.

Sir,—In your Number for 7th of March, there is an article on combustion, which contains a supposition of the practicability of obtaining incombustible wicks. There seems another consideration—the practicability of using them; for it strikes me, that an incombustible article could hardly support combustion for any length of time; if so (and a practical man can decide it), might not asbestos thread be obtained and used for the purpose? The only principle on which it might be counted on, would be capillary attraction. I have enclosed the form of the lamp I use, if you think fit to give it a place in your Magazine.

W. H.

Ilfracombe.

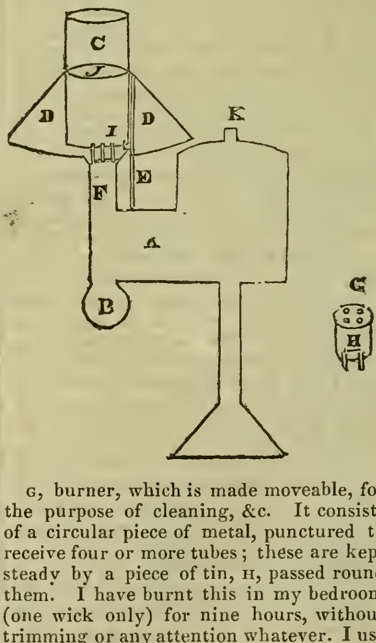
Description of Lamp.

A, thin communication between the body of the lamp and the tube, F. This tube is of a circular form.

B, receptacle for a coil of wicks, pushed down the burner.

C, the glass chimney, supported by the wire, E, with a crook at I, and a circle at J.

D, paper shade; this throws a very mellow light.



G, burner, which is made moveable, for the purpose of cleaning, &c. It consists of a circular piece of metal, punctured to receive four or more tubes; these are kept steady by a piece of tin, H, passed round them. I have burnt this in my bedroom (one wick only) for nine hours, without trimming or any attention whatever. I use what is called drawing cotton. It need

scarcely be remarked, that there must be a hole at K, to admit air.

[Amianthus or asbestos is employed for the wicks of the naptha and some other lamps—it is used in its natural state.—Ed.]

ON LATENT HEAT.

To the Editor of the Mechanic and Chemist.

Sir,—I scarcely expected my hurried and immature remarks on latent heat would have met with any notice from you. The superstitions or fictions of science appear in general to have arisen from the necessity there exists of giving a *name* to unknown causes. When first such name is given, it produces no evil effect; but. when the name becomes familiar, we are naturally led to personify it; and, as we can generally predicate *part* of its nature, we are too apt to *attempt* to explain the whole of it, which whole is, in general, inexplicable in the present state of our mental progression. Again, we pursue no regular system in giving names to unknown causes. Perhaps it would be as well if the name of the effect, with some slight modification, was given to the unknown cause; as in the word "attraction," which is evidently given for something to be attracted or drawn to the cause: but no one imagines that this term contains the slightest clue to the nature of the cause, which is at present totally hidden from us. Now in the inquiry into the nature of heat, or rather caloric (for heat is the name of the known effect, and caloric of the unknown cause), the first question is, naturally, what are its effects? Every person is able immediately to enumerate some of these—such as, it decomposes organized bodies; destroys some chemical combinations, and promotes others; possesses the property of being radiated by some kinds of surfaces, and of being reflected by others. It is itself the effect of several chemical combinations; it causes water to expand into vapour, as, likewise, many hard bodies, including several of the metals, &c. When we have got a good catalogue of well-authenticated and carefully observed facts or effects of this unknown cause, we may then try to induce the nature of the cause, from observing in what particulars the effects agree. Now, at present, I apprehend, we do not possess anything like a sufficient number of data, to enable us even to approximate towards a reasonable idea of the nature of caloric. And, again, the data we do possess, I have never observed to be systematically arranged in any work I have yet seen.

From the data we now have—and on this foundation we can alone reason—I think we shall perceive at once, that caloric is not a matter properly so called, for this short reason—that it possesses not a single sensible property of matter; and when we consider that its principal effect is a separation or repulsion of the atoms (or, to speak positively, an expansion) of the volume of the body or matter which is affected by it, we shall find many reasons to liken it to electricity, which, by the way, is excited and made apparent by the self-same means that make caloric apparent, especially in its "latent state." May it not be probable, that light, heat, and electricity, are each of them peculiar phases, appearances, or developments of the same mysterious and all-pervading influence?

I offer these remarks thus discursively, in the hope that some of your talented correspondents may take the matter up. As I am very disadvantageously situated for following out such studies, you will be kind enough to excuse any inaccuracies or want of ratiocination in the preceding.

I am, Sir, yours, &c.

Tyro Botannicus.

CLEGG'S PATENT ATMOSPHERIC RAILROAD.

A scene of unusual animation and enjoyment displayed itself yesterday at Wormholt Scrubbs, about a mile to the right of Sheppard's Bush, in consequence of a notification rather widely, though privately made, that a portion of Clegg's atmospheric railroad, laid down on the Birmingham, Bristol, and Thames Junction line, would be opened at two o'clock for the inspection of those to whom its remarkable mechanism was an object of either general or particular interest. Long before the hour alluded to, many hundreds of persons were assembled on the "smooth green turf," by which the railway works are surrounded; some modestly wending their way on foot, while others, proud

"To turn and wind a fiery Pegasus,"

presented themselves on horseback; a chief portion, however, being conveyed in carriages of every class, and not unfrequently of the most superior construction. We are happy to state, that for speed, ease, and safety, no principle of locomotion has ever been more ingeniously planned, or more fully effected. The entire trip extended to the distance of half-a-mile, and was occasionally accomplished in eighty seconds, or at the rate of twenty miles an hour.

THE CHEMIST.

ON ALKALIES.

(Continued from page 48.)

Magnesia (Earthy).—An alkaline earth, first proved to be the oxide of a metal by Sir H. Davy; the metal he called magnesium; and 100 parts of magnesia consist of

Magnesium	60
Oxygen	40
	100

Magnesia is a fine, white, light powder, without either taste or smell. It requires 5150 parts of cold water, and no less than 36,000 of boiling water for its solution. Its specific gravity is 2.3. It is fusible only by the oxyhydrogen blowpipe or voltaic flame. It attracts carbonic acid from the atmosphere, but much more slowly than lime. Magnesia is generally procured by calcining the natural carbonate; but, to procure it pure, dissolve any quantity of the sulphate of magnesia (Epsom salts) in water, and add to the solution subcarbonate of potassa; double decomposition ensues; sulphate of potassa and subcarbonate of magnesia, which precipitate, are the result. Boil the precipitate with distilled water, to free it from adhering sulphate of potassa; dry it and expose it in a crucible to a bright-red heat; this drives off the carbonic acid, and leaves pure magnesia. The subcarbonate of magnesia, or magnesia alba of the apothecary, has been proposed by Mr. E. Davy to be added to damaged flour, to counteract its acescancy.

Morphia (Vegeto).—M. Robiquet employs the following process to obtain this alkali:—A concentrated solution of opium is boiled with a small quantity of magnesia ($2\frac{1}{2}$ drachms to a pound of opium) for a quarter of an hour; a greyish precipitate forms. The solution has then to be filtered, and the precipitate washed with cold water; after it is well dried, it is to be treated with weak alcohol, and allowed to macerate for some time with a heat under ebullition, by which a great quantity of colouring matter is taken up. The mass is again filtered and washed with cold alcohol; subsequently it is dissolved by a greater quantity of rectified alcohol, which is kept boiling, and, while in that state, is filtered once more. On cooling, the liquor deposits morphia. By the spontaneous evaporation of the alcoholic solution, it may be procured in regular crystals, which are transparent; these crystals are hydrate of morphia. If gently heated, they lose their water and become opaque. At a high temperature, they fuse into a yellow liquid. Morphia burns with a bright flame; it is soluble in 100 parts of boiling, and 40 of cold water. It requires 30 of anhydrous boiling alcohol for its solution; but is insoluble in ether. The average quantity of morphia obtained from opium, is about one ounce in a pound. In its anhydrous state, it consists of

Carbon	71.80
Hydrogen	6.34
Oxygen	16.90
Nitrogen	4.96
	100.00

Narceia (Vegeto) was discovered in 1832 by the celebrated chemist, Pelletier. The following was the process by which it was obtained:—An infusion of Turkey opium was filtered and carefully evaporated, till it left a solid extract, which, being redissolved in water, left a large portion of narcotina; this being separated, the liquid was heated to 212° Fahr., and a slight excess of ammonia added, to throw down morphia; after which, the ebullition was continued for ten minutes, to drive off the ammonia. On cooling, the remaining morphia was deposited. The residuary liquor was then reduced to half its bulk by evaporation, and baryta water was added to it, by which mecozate of baryta is formed; this is separated by filtration. Subcarbonate of ammonia was then added to throw down the remaining baryta. Heat was then applied to drive off any excess of the ammoniacal salt that might remain. The liquor was then filtered, evaporated to the consistence of syrup, and left for several days in a cool place, when it formed a pulpy mass, including crystals; this was suffered to drain, dried by strong pressure in linen, and then digested in boiling alcohol. The alcoholic solution, reduced to a small bulk by distillation, furnished, on cooling, a crystalline mass; this, purified by repeated solutions and crystallizations, is the subject in question. Pure narceia is soluble in 375 parts of cold, and in 230 of boiling water. It is soluble in alcohol, but not in ether. At a higher temperature than 220° Fahr., it is decomposed. It is also decomposed by strong acids; but when diluted, they dissolve and combine with it, producing at first a blue colour, which passes into purple, then red, and eventually disappears. According to the analysis of M. Pelletier, it is composed of

Carbon	54.73
Hydrogen	6.52
Oxygen	34.42
Nitrogen	4.33
	100.00

Narcotina (Vegeto).—The alkaline characters of this substance are not very distinct; but its ultimate composition, and its combining with acids, places it among them. Narcotina may be obtained by making an ethereal tincture of opium, by which only the caoutchouc and the narcotina are taken up. It must subsequently be purified by solution in, and evaporation of alcohol: it is then obtained in well-defined crystals, which are slightly soluble in hot, but insoluble in cold water. It combines with acids, more especially the hydrochloric. From its strong exciting powers, if taken into the stomach alone, it causes an unnatural brilliancy of the eyes, contraction of the pupils, and giddiness. According to the last analysis of M. Pelletier, it consists of

Carbon	65.16
Hydrogen	5.45
Nitrogen	4.31
Oxygen	25.08
	100.00

S. Piesse.

CHARCOAL.

To the Editor of the Mechanic and Chemist.

Sir,—The following table contains the result of some experiments made by Mr. Mushet, on the quantity of charcoal afforded by different woods:—

100 parts of Lignum Vitæ yield	26.8
Mahogany	25.4
Laburnum	24.5
Chestnut	23.2
Oak	22.6
American Black Beech	21.4
Walnut	20.6
Holly	19.9
Beech	19.9
American Maple	19.9
Elm	19.5
Norway Pine	19.2
Sallow	18.4
Ash	17.9
Birch	17.4
Scottish Fir	16.4

S. Piesse.

MISCELLANEA.

Hints for Workmen.—The faults of well-paid workmen are not deficient industry, but excessive, or, at least, irregular exertion. Excessive application during one part of the week, is frequently the cause of idleness complained of during the remainder. Great labour, either of mind or body, continued for several days together, is, in most men, naturally followed by a great desire for relaxation, which, if not restrained by force, or some strong necessity, is almost irresistible. It is the call of nature, which requires to be relieved by some indulgence or change of occupation. Relaxation does not always imply idleness, but " easing the wearied part," by exchange of employment. If not complied with, the consequences are often dangerous and sometimes fatal; and such as almost always bring on, sooner or later, the infirmity of the trade. If masters would be more humane, and journeymen more reasonable, both would see the utility of temperate exertions of industry. The man who works so moderately as to be able to work constantly, not only preserves his health the longest, but, in the course of the year, executes the greatest quantity of work. Labour, without reasonable intervals of rest for meals and relaxation, exhausts the energies of both body and mind, and is, of the two, more hurtful than low wages, which abridge diet and physical comforts.

Price of Labour.—As the high price of labour produced by scarcity of workmen, is the fortress that protects all their comforts and inconveniences, they ought never to yield an inch of the " vantage ground" without dire necessity. The example of such individuals, or bodies of individuals, as submit quietly to have their wages reduced, and who are content if they get only the mere necessaries of life, ought never to be held up for public imitation. On the contrary, everything should be done to make such apathy esteemed disgraceful. The best interests of society require that the rate of wages should be elevated as high as possible—that a taste for the comforts, luxuries, and enjoyments of life, should be widely diffused, and, if possible, interwoven with national habits and prejudices. Very low wages, by rendering it impossible for any increased exertions to obtain any considerable increase of comforts and enjoyments, effectually hinders them from being made, and is, of all others, the most powerful cause of that idleness and apathy, that contents itself with what can barely continue animal existence. Is the improvement in the circumstances of the lower ranks of the people to be regarded as an advantage, or as an inconvenience to society? The answer seems at first abundantly plain. Servants, labourers, and workmen of different kinds, make up the far greater part of every great political society. But what improves the circumstances of the greater part, can never be regarded as an inconvenience to the whole. No society can surely be flourishing and happy, of which the far greater part of the members are poor and miserable. It is but equity, besides, that they who feed, clothe, and lodge the whole body of the people, should have such a share of the produce of their own labour, as to be themselves to-

lerably well fed, clothed, and lodged. Government is interested not less than the people in the diffusion of such sentiments. Government cannot be rich, while the body of the community is indigent; it cannot be safe, while that on which it mainly rests cannot be depended on for support. It is not the opulent who demand legislative attention; they are exempt from want, and, as they assume to be educated, they ought to be exempt from crime; they form that part of the social waste which has been reclaimed and cultivated: but the poor, if not still in the wilderness, are only on its verge, and require to be brought forward by the application of those practical truths I have endeavoured to explain and enforce.—*History of the Middle and Working Classes.*

Whirlpools.—Two currents of equal force, but of different directions, meeting in a narrow passage or gut, will cause what is generally called a whirlpool, and has ignorantly been said to be produced by subterranean rivers, gulfs, chasms, &c.; but essentially is only an eddy, produced by the contact of two currents, which, as if meeting on a centre, whirl round, as it were, in each other's arms. The whirlpool named the Euripides, near the coast of Greece, alternately absorbs and rejects the water seven times in twenty-four hours. Charybdis, in the Straits of Sicily, absorbs and rejects the water three times in twenty-four hours; and the Maelstrom, on the coast of Norway, which is considerably the largest, absorbs, every six hours, water, ships, whales—in short, everything that approaches its malignant influence, and the next six hours is employed in casting them up again. These eddies are sometimes augmented by the force of contending tides, or by the action of the winds They draw vessels along, dash them upon rocks, or engulf them in their furious vortices, the wreck not appearing until some time after.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, July 25, William Basham, Esq., M.D., on the Comparative Physiology of Respiration. At half-past eight.

Poplar Institution, East India Road.—Tuesday, June 23, W. Gibbins, Esq., on Astronomy. At eight o'clock precisely.

QUERIES.

1. A receipt for making caoutchoucine, or India-rubber court plaister? 2. How to make the paste for fixing paper hangings to walls, and directions for performing the work? 3. A receipt for making the best kind of plate-powder? 4. Which would be the quickest and easiest way to kill oak, ash, or elm-timber trees; as I am informed that, if the trees were killed and left standing for some time afterwards, the timber would be of a much superior quality for many uses? 5. Is there a preparation made and sold by chemists or druggists, from a plant called catananch coerulea; and if so, what are its uses and effects (if taken internally) on the human constitution? 6. I wish to be informed of the best and cheapest work on algebra. 7. The newest and most approved work on analyzing soils of all kinds, and also for fertilizing all kinds of inferior and barren soils? N. M. T.

What are the best kind of boilers now in use for condensing engines; and in what does their superiority chiefly consist? Y. E.

A description of the Cornish expansion engine, its mode of operation, and whether the principle is likely to be generally adopted; and if so, what would the result be, as it regards the expense of erection, the cost of fuel, &c.? Would it eventually supersede the common condensing double-power engines now working? Is it adapted for drawing coals, and would it answer all the purposes for which steam-engines are required at a colliery. YOUNG ENGINEER.

A description of Professor Mascati's anemoscope, and also that of Cavalier Marsilio Landriani's, having, some time back, invented an instrument for the same purpose? I have submitted it to the opinions of several scientific gentlemen, and they think a good instrument of that kind is very desirable for meteorological observations, &c. C. A. BOWDLER.

What is oil of Behn, and what made from? B. MOUNTFORT.

The proper method of gilding letters, figures, &c., on glass? THOMAS LEE.

The cheapest and best way in which pyroligneous acid is obtained, to make a quantity at once? T. F. B.

ANSWER TO QUERIESS.

To Prepare Phosphuretted Ether.—Let sulphuric, that is, common ether, stand over a quantity of phosphorus in a well-stopped vial for several weeks. The solution is aided by occasional agitation. Ether dissolves but a very small quantity of phosphorus; but the solution is so strong, that if a bottle containing it is opened in the dark, there is sufficient light to see the time on a match. B. MOUNTFORT.

TO CORRESPONDENTS.

J. C. L.—*We will endeavour to obtain the information he desires.*

A Constant Reader.—*We shall be happy upon all occasions to promote the cause of popular instruction and our correspondent's suggestions shall not be lost sight of.*

Epictetus *will find the process of fixing photogenic drawing on paper, in No. 38, N. S., of the "Mechanic."*

ERRATUM.—Page 14, line 16, Vol. VI. No. 2, for "Dahuria" read *Daturia.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

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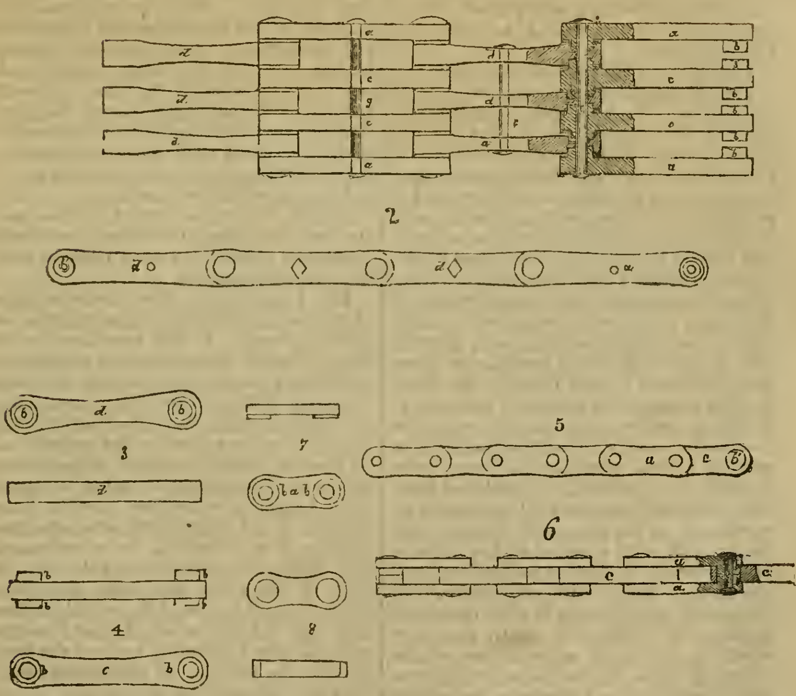
CUTLER'S PATENT FOR CONSTRUCTING CHAINS.

FIG. 1.



City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

CUTLER'S IMPROVED METHOD OF CONSTRUCTING CHAINS, &c.

(*Abstract of Specification.*)

My invention relates, first, to certain novel constructions of wrought-iron chains, wherein the parts are so formed and combined, as to offer greater security; and chains so constructed are less liable to fracture and derangement, than the various wrought and other iron chains heretofore constructed.

Secondly, the invention relates to the means of forming the links, bars, and bolts, of such novel construction of chains. And in order to give the best information in my power, I will proceed to describe the engraving (see front page), in which the same letters of reference are used to indicate similar parts wherever they occur.

Description of the Drawing.

Fig. 1 represents a plan of part of a chain constructed and combined according to my invention.

Fig. 2 is an edge view of fig. 1; and

Figs. 3 and 4 show separate parts of such chain. The principle on which this chain is constructed is such, that one set of bars, links, or bolts, have circular, by preference cylindrical, projections formed thereon; and the other set of bars, links, or bolts, have corresponding circular, and by preference cylindrical, sockets or cavities formed therein; so that when a projection of one bar enters a socket or cavity of another bar, the one shall correctly fit the other, yet allow of the projection turning in the socket or cavity; and, in addition to such sockets and projections, there are to be holes formed through the bars, passing through the centre of each cylindrical projection, and also through the cavities or sockets, through which a pin is passed; hence, when any number of pairs of links, bars, or bolts, are combined together, they will each and all be capable of movement on the pin; and, farther, each bar or link with a socket will be capable of movement on circular projections, and the bars or links, with projections, will be capable of movement in their respective sockets, all which will readily be understood on a careful examination of the drawing, aided by the following explanation thereof:—*a a* represents the outside bars, links, or bolts of the chain; they have each hollow cylindrical projections, *b b*, as is already shown in the drawing; *c c* are the minor links, bars, or bolts, which have each four cylindrical projections, *b*, two at each end, but on opposite sides of the bars; *d d d* are links, bolts, or bars, each having four cylindrical cavities or sockets, b^1, to receive the projections, *b*, of the bars, *a c*. It will be seen that there are four bars, bolts, or links, *a c*, to three of the links, bolts, or bars, *d*; consequently, in order to make all parts of the chain equally strong, or as nearly so as possible, the three bolts, bars, or links, *d*, should be each somewhat stronger than a bar, bolt, or link, *a c*. The two sets of bars, bolts, or links, are combined together by means of the wrought-iron pin, *e*, which is passed through the holes formed through the centres of the cylindric projections, and through the holes in the sockets. The pins, *e*, may be fastened by rivetting, or by having a head at one end, and screw and nut at the other; *f g* are pins which pass through the links, bars, or bolts, *a c* and *d*, by which the parts are more closely combined, and offer a means of holding the chain together, even though a pin, *e*, should be broken or fall out; for it will be evident that the sockets and projections, being retained together by the pins, *f g*, the chain would work safely; but I consider the pins, *e*, should at all times be employed, though the pins, *f* and *g*, may be dispensed with when desired, and, when used, they may be rivetted, or have screws or nuts, as shown.

Fig. 5 shows a plan; and

Fig. 6, an edge-view of chains constructed according to another part of my invention, differing in some respects from that already described.

Fig. 7 and fig. 8 show separate views of the two descriptions of bars, links, or bolts employed. In this case there is one class of bolts, bars, or links, which have cylindrical projections, similar to those already described; the other bars, links, or bolts, having holes formed through them of the same form as the projections, in place of having recesses, consequently two bars with projections being laid together, having another bar, *d*, with holes through it (of the required size), the projections may be said to act as an axis to the other or intermediate bolt, bar, or link, *d*, on which the same may turn freely. In this case I have only shown two bars, *a a*, to one bar, *d*; but it will be evident, that by forming some of the bars, *a*, like the bars, *c*, of the former chain, that is, having four projections, *b*, on each, a wide chain may be made according to the purpose to which it is to be applied; and it will be evident, that by combining the links, bars, or bolts, *a a*, in pairs with one link, *d*, to each pair, a chain may be made only half the width of fig. 1; and farther, by using more of the

links, bars, or bolts, *c* and *d*, wider chains may be made than those shown at fig. 1.

I would remark, that the chain shown at fig. 1, is suitable for pit-chains, cables, and suspension-bridges, the only difference being, that in making chains for suspension-bridges, the links, bolts, or bars, must be longer and stronger in proportion to their increased size; and the chain. fig. 5, is suitable for driving machinery, or other purposes; my invention only relating to the modes of forming the junctions of the links, bolts, or bars, for whatever purpose they may be applied. I have not thought it necessary to show many different lengths of links or bars, and they will necessarily be varied according to the purpose to which they are to be applied; as will also their figure or shape, while the modes of connexion will remain the same. It is important that the various parts of such chains should be made with care and with considerable accuracy, in order that one link, bar, or bolt, should not have to bear more strain than another, and that the sockets and projections should accurately fit, allowing, however, of the same turning with freedom. And, in order to accomplish such accuracy of the parts, I have invented suitable dies for stamping the bars, links, or bolts, *a c d*. For making the bars, *a*, I have two dies fitting accurately together, and having projecting studs and holes to receive them; whereby the two dies are at all times insured going accurately together. In one such die is formed a recess of the figure of the bar, link, or bolt, *a*, and of such a depth as to receive about half the thickness of such a link, *a*. The other die is similarly sunk to the first; but, in addition thereto, there are two recesses therein, equal to forming or shaping the projections, *b*, with a nipple or stud in the centre, for the purpose of piercing the necessary hole for the pin to pass through; but if such hole should not be pierced entirely through by stamping, the piercing may be perfected by the means of a pair of piercing tools in a press; and, in forming the bars, *c*, two dies, such as the one last described, are to be used, in order to form or shape the projections, *b*, on each side of the bars, links, or bolts, *c*, with nipples or studs therein, to pierce the hole for the pins to pass through, as before described. In making the bars, bolts, or links, *d*, the dies are to be the reverse of those for producing the projections, *b*, such dies having projections formed therein to produce the sockets.

I would remark, that I am aware that the links, bolts, or bars, of ordinary chains have been before made by stamping them in dies; I do not, therefore, claim the use of dies for such purposes generally, but my invention only relates to the improved mode of constructing dies suitable for shaping projections, *b*, and for producing cavities or sockets, b^1, as herein explained. In forming the bolts, bars, or links, previously to stamping, I either forge the same into as nearly the figure desired as possible by hand, or cut them out of thick sheet-iron, by means of a pair of tools worked in a press; or else I have bars rolled, leaving projections or recesses (as the case may be) at suitable intervals, and each link being heated to a bright-red heat, it is inserted into its proper dies; and by pressure or by blows, the same are caused to close and produce the figure of link, bolt, or bar desired; after which the projections, *b*, and the cavities, are to be finished in the lathe by means of suitable tools.

NELSON'S IMPROVED METHODS OF PREPARING GELATINE, &c.

As this process throws much light upon the nature of glue, size, and eatable jelly or gelatine, we give the patentee's account, with no farther abridgment than the omission of the passages relating only to the chicanery of the law.

" My invention consists in using or applying to the glue-pieces which I use, a caustic-alkaline solution, either with or without acid or acids (not being sulphurous acid in a liquid state), without such solution for preparing gelatine, which has the properties of, or resembles glue. Before I apply my invention, the glue-pieces which I use must be freed from hair or wool, and flesh and fat, and then washed clean in cold water; and when I make the gelatine, which I call my gelatine of the first quality, I prefer to use the cuttings of the hides of beasts or of the skins of calves.

I shall first describe the method by which I prepare the gelatine, which I call my gelatine of the first quality; and for the purpose of reference, I designate this method the first operation. I have already stated, that when I make this gelatine, I prefer to use the cuttings of the hides of beasts or of the skins of calves. When the cuttings have been freed from hair, flesh, and fat, and washed clean in cold water, I score the grain side of them to the depth of about an eighth part of an inch, in lines about an inch apart, in order to facilitate the action of the alkali which I use, and to render such action more uniform. I then macerate them in

a caustic solution of alkali, at a temperature of about 60° of Fahrenheit, using for this purpose brick vats or vessels, lined with cement in the ordinary manner; and these vats or vessels, which I call the macerating vessels, must be covered with lids excluding the general atmosphere; any vessels which are not acted upon by the alkali may be used. I thus macerate the cuttings until I can pass a fork or any other similar instrument through them with little resistance, and I generally find that they are sufficiently macerated in about ten days. The alkali which I prefer for my solution is soda, and I prepare my solution in the ordinary method, using three parts of the common soda of commerce, with two parts of fresh-burnt lime to sixteen parts water; or any quantity of fresh-burnt lime, sufficient to render the solution caustic, may be used. When the process of maceration is sufficiently complete, as already pointed out, I remove the cuttings from the solution, and put them into vessels similar to the macerating vessels, and which must also be covered with lids, excluding the general atmosphere; and I leave them in such vessels thus covered until they have become sufficiently soft. It will be ascertained whether they have become sufficiently soft, by passing a fork or other similar instrument through them; and when they have become sufficiently soft, the flock or other instrument will pass easily through them. While the cuttings are thus left to become soft, they must be kept at a temperature between 60° and 70° of Fahrenheit; and, as they become sufficiently soft, as above pointed out, I remove them, and I slice or split such of the cuttings as are materially thicker than the others, in order to bring them to the same or nearly the same thickness. I then put the cuttings into wooden cylinders placed in water-vessels, filled with clean cold water; but care must be taken not to put into any cylinder more than half the quantity which it is capable of containing. These cylinders, which I call washing cylinders, must be constructed in such manner as to allow water to pass freely through them, and they may be fitted in the water-vessels in any convenient manner, to allow of their revolving within such vessels. I secure the cuttings within these cylinders, and then I cause the cylinders to revolve slowly in the water. I have found cylinders of three feet in diameter a convenient size, and I cause these to revolve at a speed of about one revolution in a minute. While the washing cylinders are thus revolving, I cause a current of water to be kept up through each of the water-vessels, by means of an aperture at the bottom of the vessel at one end, and a pipe at the top at the opposite end, through which pipe clean cold water is continually supplied. I continue the cylinders revolving in a current of water, as I have described, until the alkali is sufficiently washed out of the cuttings; and I generally find six or seven days sufficient for this washing, when I use cuttings of ordinary thickness; but when I use cuttings which are thicker than these, I continue the washing in proportion to the thickness of such cuttings. When the cuttings have been thus washed, I remove them from the washing cylinders, and place them in a wooden closet, constructed in the ordinary method, to prevent the escape of gas, and there expose them to the direct action of sulphurous-acid gas, produced by the combustion of sulphur within the closet. I continue the cuttings thus exposed to the direct action of this gas, until they have a slight excess of acid; and I ascertain whether they have an excess of acid, by testing them with litmus paper in the ordinary manner. I then remove them from the closet, and press them by any ordinary means, to separate as much water as possible; and, after they have been thus pressed, I put them into glazed earthenware vessels, or any other vessels which are not acted upon by acid. I call these vessels steam-baths, and I apply steam to them in the manner usually employed for heating steam-baths; but any other convenient means of heating them may be used; I thus bring the cuttings to a temperature of about 150° of Fahrenheit, and I keep them at this temperature, and by means of a suitable wooden instrument, I stir or agitate them until they are almost entirely dissolved. The liquid thus formed is gelatine, and I separate it from the residuum which remains undissolved, by straining, and put it into vessels, which I call settling vessels, and which are constructed in the same manner as the steam-baths. I heat these settling vessels in the manner which I have already pointed out for heating the steam-baths. While this liquid gelatine is in these settling vessels, it should be kept at a temperature between 100° and 120° of Fahrenheit, and I allow it to remain undisturbed in the settling vessels, for the purpose of clearing it, until I consider that the impurities which it contains have sufficiently settled or subsided; I generally find nine hours sufficient for this purpose; but if the impurities have not sufficiently settled or subsided in that time, I prefer to clear it

by straining it through a woollen cloth. I remove the liquid gelatine from the settling vessels by means of a syphon; but any other suitable means may be used for this purpose, and after it has been sufficiently cleared I pour it upon slabs, which I call cooling slabs, to the depth of about half-an-inch. These slabs may be of stone or slate or marble; but they must have frames of some convenient material, at least half-an-inch in depth, fitted to their edges, and care should be taken to place the slabs in cool situations. I allow this gelatine to remain upon the slabs until it becomes cold, and sets into a firm substance; and I then cut it into pieces, and wash these in the washing cylinders and water-vessels, which I have already described for that purpose in respect to the cutting, as I take them from the macerating vessels. This washing must be continued until the excess of acid is entirely, or nearly altogether removed from the gelatine, and I generally find that three days are sufficient for this purpose; but I ascertain whether the excess of acid has been removed, by testing the gelatine with litmus paper in the ordinary manner. After the excess of acid has been thus removed, I take the gelatine from the cylinders and put it into the steam-baths, and then dissolve it, by applying heat to the baths in the manner which I have already pointed out for that purpose; but it will be desirable to avoid raising the temperature of the gelatine above 85° of Fahrenheit. When the gelatine has been thus completely dissolved, I pour it again upon the cooling slabs, as before, and I allow it to remain until it becomes again cold, and sets into a firm substance. I then cut it into pieces of any convenient size, and dry it upon nets by exposure to a current of cool dry air; and when it has been thus completely dried, it is fit for use.

In the operation which I have described, I have stated that a residuum of the cuttings remains undissolved. This undissolved residuum may be used in the manner which I have hereinafter mentioned for that purpose.

I call the gelatine which I obtain by the operation already described, my gelatine of the first quality; but equally good gelatine may be obtained from the cuttings of the hides of beasts, and of the skins of calves, by the use or application of alkali, without using or applying acid to such cuttings; and I shall now describe the method which I employ for this purpose, and for the purpose of reference, I designate this method the second operation. I treat the cuttings in the manner which I have described in the first operation, until they have been washed and taken from the washing cylinders, and I then press them, by any ordinary means, to separate as much water as possible; and, after they have been thus pressed, I put them into the vessels which I call steam-baths, and heat these vessels by applying steam in the usual way for that purpose, until the cuttings attain a temperature of 120° of Fahrenheit; but any other convenient means of heating these vessels may be used. I keep the cuttings at this temperature, and stir or agitate them by any ordinary means for about four hours. The cuttings will thus be partially dissolved, but in a smaller proportion than by the first operation. The liquid thus formed is gelatine, and I separate it from the residuum, which remains undissolved, by straining, and put it into the settling vessels. I heat these vessels in the manner which I have already pointed out for that purpose; and while this liquid remains in these vessels, it should be kept at a temperature of 105° of Fahr. I allow the gelatine to remain undisturbed in these vessels, until the impurities which it contains have sufficiently settled or subsided. I generally find six hours sufficient, but it may be allowed to remain longer if considered desirable. After it has been thus cleared, I remove the liquid gelatine from the settling vessels, in the manner which I have already described for that purpose, and pour it upon the cooling slabs to the depth of about half-an-inch, and I allow it to remain upon these slabs until it becomes cold, and sets into a firm substance; I then cut it into pieces of a convenient size, and dry it upon nets, by exposure to a current of cool dry air; and, when it has been thus completely dried, it is fit for use."

(*To be continued.*)

SPECIFICATION OF BOGARDUS'S PATENT

FOR IMPROVED MEANS OF APPLYING LABELS, STAMPS, OR MARKS TO LETTERS, &c.

To all to whom these presents shall come, &c. &c.—Now know ye, that in compliance with the said proviso, I, the said James Bogardus, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained, in and by the following statement thereof; that is to say:—

The object of my invention is, to annex

a stamped or engraved label to a letter or other document, by means of the seal, thus avoiding the use of adhesive or gummed labels.

The label, whether of paper or parchment, may be of any size or shape; and if it be required to affix one to a letter by means of a wafer, let the wafer cover a portion of the label, and the rest of the wafer will seal the letter; the same may be done with wax.

But a better method is, to cut or pierce a hole in the label, which hole, being placed where the wafer or wax is placed to seal the letter, the act of sealing the letter affixes the label, and this method may be applied to any document whatever. In witness whereof, &c.

Enrolled February 26, 1840.

USE OF GOLD LEAF IN THE SMALL-POX.

The discussions which are now proceeding in the House of Commons, and the investigations which have been instituted for the purpose of ascertaining the effect of variolous innoculation, have brought to light numerous facts, which show that the ravages of that dreadful disease, the small-pox, are, notwithstanding the progress of medical science, still felt to a fearful extent, especially among the poorer classes. In cases where the disease has been induced by innoculation, it has been found so intense and virulent, that when death has not ensued, it has most frequently left ineffaceable traces of its presence, and disfigured the features by scars which remain till the end of life. Two years ago, M. Larrey, in a note read to the French Academy, said that the Egyptians and Arabs preserved the faces of young persons from the disorganizing action of the small-pox, by covering them with gold leaf at the moment of the attack of the malady. At a recent meeting of the same learned body, Dr. Legrand announced that he had tried, with complete success, the application of this method to a young female, attacked by a confluent small-pox. From the first instant of the eruption to the end of the fever of superation, he covered, night and morning, the whole face with leaves of fine gold, such as are used for gilding; and he caused them to adhere by applying a little gum water. With the exception of some places on the side, where the gilding was rubbed off by contact with the pillow; the face, although it had undergone a great tumification, was perfectly preserved, and the features retained all their delicacy. The hands, which had not been submitted to the same preservative process, presented some characteristic marks. Surely, after this favourable report from so respectable an authority, the medical profession of this country will not reject so innocent a mode of treatment without a fair trial.

THE CHEMIST.

CHEMICAL ANALYSIS.

(Continued from page 300.)

CHARACTERS OF GASES.

The three principal gases—oxygen, hydrogen, and carbonic acid, having already been described, with the means used for detecting their quantity when mixed with other gases; I now deem it almost necessary to give a description of the principal characters of gases—as their colour, whether inflammable or non-inflammable, absorption by water, &c.; as a means of lessening, in a great measure, the trouble attending on gaseous analysis.

1. Protoxide and deutoxide of chlorine are of a yellowish-green colour; nitrous acid, red.

2. The gases destitute of smell, are oxygen, hydrogen, nitrogen, protoxide of nitrogen, carbonic acid, and carburetted hydrogen, when extremely pure.

3. Those that are inflammable in open air when lighted, are hydrogen and its carburets and phosphurets, potassuretted hydrogen, sulphuretted, telluretted, and arsenuretted hydrogen, cyanogen, and carbonous oxide.

4. Those, if into which a recently extinguished taper be introduced, are the cause of its rekindling, they are oxygen, protoxide of nitrogen, nitrous acid, and the oxides of chlorine.

5. Alkaline gases—ammonia and potassuretted hydrogen.

6. Acid gases, which redden infusion of litmus or blue gilliflowers; such are the oxides of chlorine, cyanogen, sulphuretted and telluretted hydrogen, fluoboric, muriatic, hydriodic, sulphurous, chlorocarbonic, carbonic, nitrous, and fluosilicic acids.

7. Soluble in alkaline solutions; such are the oxides of chlorine, sulphuretted and telluretted hydrogen, ammonia, and the hydriodic, fluosilicic, chloric, carbonic, chlorocarbonic, nitrous, muriatic, sulphurous, and fluoboric acids.

8. Soluble in one-thirtieth its volume of water; such are the muriatic, nitrous, sulphurous, fluosilicic, and fluoboric acids, and ammonia.

9. Producing white vapour in the air—fluoboric, fluosilicic, hydriodic, and muriatic acids.

Peculiar Characteristics of the different Gases.

(Specific gravity of air taken as 1.00.)

1. *Oxygen*, sp. gr. 1.1111; weight of 100 cubic inches 33.888 gr. heavier than atmospheric air; absorbed by water in a small degree, inflammatory, and detonates with hydrogen.

2. *Hydrogen*, when freed from water, sp. gr. 0.0694; at 60° Fahr., and 30° in barom. press.; 100 cubic inches weigh 2.118 gr.; colourless, garlic odour, combustible, flame yellowish, white colour, with a reddish tinge, and extinguishes animal life by inspiration; is fired by spongy palladium or platinum.

3. *Nitrogen* or *Azote*, sp. gr. 0.9722; 100 cubic inches weigh 29.65 grs.; extinguishes flame and animal life; destitute of smell or taste; yields ammonia by ignition in a glass tube.

4. *Carbon*, sp. gr. 0.4166; 100 cubic inches weigh 12.708 grs.

5. *Cyanogen*, sp. gr. 1.8064; 100 cubic inches weigh 55.1295 grs.; penetrating smell, inflammable, colour of flame blue. Water at 68° absorbs $4\frac{1}{2}$ times its volume, and acquires a sharp taste. Pure alcohol absorbs 23 times its volume, reddens litmus (but the colour is restored by heat), and deprives of colour the red sulphate of manganese.

MANIPULATOR.

MISCELLANEA.

Beautiful Metallic Crystals.—Over one ounce of iron filings in a tea-cup, pour a table-spoonful of sulphuric acid, diluted with four times its quantity of water; boil it for a short time, and set it aside to cool, when beautiful crystals of sulphate of iron will be formed. E. L.

To give a Person a Supernatural Appearance.—Put one part of phosphorus into six of olive oil, and digest them in a sand heat. Rub this on the face, and the appearance in the dark will be supernaturally frightful.

Diminution of the Sun's Light.—It has been calculated that the sun's light, when he is at the horizon, is diminished 1300 times before it reaches the surface of the earth, by reason of the great column of air which it has to traverse.

P. A.

[This is a mistake; the phenomenon is explained by the *impurity* of the vapours near the surface of the earth, not their *extent*, and the dispersion of the rays by refraction.—ED.]

Machinery enters into competition with human labour; and, therefore, there are some people who say, let us tax machinery to support the labour which it supersedes. The real meaning of this is—let us tax machinery to prevent cheapness of production, to discourage invention, and to interfere with a change from one mode of labour to another mode. There are temporary inconveniences, doubtless, in machinery; but every man who suffers from these inconveniences, possesses in himself the power of remedying those evils, or, at least, of mitigating them. But any proposed remedy for a temporary evil, which has a tendency to arrest the course of improvement, is a little like the ancient wisdom of the Dutch market woman, who, when the one pannier of her ass is too heavily laden with cabbages, puts a stone into the other pannier to make matters equal.—*Working Man's Companion.*

Coffee.—The first mention of coffee in the west of Europe is by Ramsoff, a German traveller, who returned from Syria in 1573. It was first brought into England by Mr. Nathaniel Conopius, a Cretan, who made it his common beverage, at Baliol College, Oxford, in 1641. Coffee trees were conveyed from Mocha to Holland in 1627, and carried to the West Indies in the year 1726; first cultivated at Surinam by the Dutch in 1718, and its culture encouraged in the plantations in 1732.

A Wild Cat, of the following extraordinary dimensions, was caught on the farm of Kilnford, parish of Dundonal, on Tuesday, the 19th of May, 1840—viz., from the snout to the tip of the tail, along the back, 2 ft. $11\frac{1}{2}$ in.; from the above extremities, over the fore and hinder feet (as in running), 4 ft.; height at shoulder, $14\frac{1}{2}$ inches. Although burdened with a heavy rabbit stamp, in which it was caught, the courageous grimalkin faced about several times, and seemed determined to sell his life at the dearest rate; and it was with no little trouble that he was at last secured.

I. S. D.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, July 2, John Fisher Murray, Esq., on the Writings and Genius of Homer. At half past eight.

Poplar Institution, East India Road.—Tuesday, June 30, J. Bateman, Esq., on Acoustics. At eight o'clock precisely.

QUERIES.

I have tried to render cloth water-proof, as stated by your correspondent, "E. J. S." of No. 35 of your Journal, but have failed. Perhaps that correspondent will be so kind as to say how it is to be applied, as I suppose I have not used it right? J. S. D.

Sir, I should consider it a very great favour if I could be instructed, through the medium of your publication, the best mode of heating a room 60 feet × 40 feet, to a temperature of 200°. Coal only is intended to be employed in generating the heat; and it is very desirable that it should be uniform throughout the whole extent of

the room. Perhaps I ought to observe, that the fire or fires must be placed at the outside of the room, and the flues conducted underneath the floor; and it is the method of such fluing that I wish to be informed of. If, however, any better mode of disposing the flues could be suggested, so as to produce the above temperature, I shall be happy to have an explanation of it.

SHERWOOD.

[To obtain so high a temperature, the flues must be numerous, and ought to intersect the apartment in different places; but their disposition must of course be regulated by the space that can be spared. Steam is, beyond comparison, superior to any other medium for distributing heat to a great distance. If our correspondent had stated for what purpose this great heat was required, or, at least, what portions of the apartment might be destined for the flues, the solution of his problem would have been much facilitated; and it would also have been proper to have mentioned the height of the room. With these suggestions, we leave the subject as an "open question" for the consideration of our numerous and enlightened readers.—ED.]

The principle of the "Manifold Writer," and wherein it differs from the copying machine? Also how I might construct a manifold writer; for I believe that is the most simple?

J. K. A.

How to clean globes? C. R.

1. How to take ink stains out of paper? 2. How to clean white kid gloves? 3. How to take grease stains out of paper? G. F. GIBBS.

1. How to purify quicksilver? 2. How to make a wheel barometer? 3. How to make yellow brass? 4. How to make hard solder for brass and copper? 5. How to tin brass and copper? 6. How to make the metal that spoons are made of called tooth-and-egg? 7. How to make sulphuretted hydrogen? E. L.

The process of blowing joints to pewter pipe, what the solder consists of, how to make the same, and where I can purchase a proper blow-pipe for the occasion? Also, if there is a means of tining cast and wrought-iron pipe without the application of heat? I have been given to understand, that it can be done; if so, I shall feel much obliged if any of your correspondents can inform me of the process, and what I shall require for the process, and whether it would answer to solder lead pipe to it, for instance? Also the method of polishing the horns of the buffalo, such as I have seen on chimney-pieces, and the cheapest and best place to get them mounted with silver?

J. D.

By experience I have found, that all vegetable oils are, from the gums and acids they contain, quick in clogging in machinery, and also, from that circumstance, are unfit for many other uses. Trotter oil being an animal one, and, when purified, would be very good for my purpose, if some of your correspondents could let me know where some is kept pure in store? Q. M.

How to make the varnish used for paper, such as cards, &c.? P. T.

ANSWERS TO QUERIES.

In answer to a "Y. E.'s" inquiries respecting the best kind of boilers for condensing engines, I beg to state, that the cylindrical or tubular boilers are best; and their superiority consists in the greater strain they will bear, the convenience of their form, and the great extent of flue surface, which not only raises the steam quicker, but keeps it generated at about one-third of the supply of fuel used to other boilers. But this superiority will not appear, if the boiler be not covered to prevent radiation of heat: they are best covered with saw-dust or cinder-ashes, to the depth of twelve inches. Engineers are not generally aware of the saving, by adopting means to prevent radiation; they may have been told of it—they may have read, but they must see it ere they will sufficiently open their eyes to its importance; and let any one try it—let him enclose his boilers, his steam-pipes, and his cylinder, pretty thickly, with any non-conducting substance (saw-dust or cinder-ashes are best), and he will find, where he spent 100*l.* for fuel, he will now spend but 30*l.* or 40*l.*; he must also so set his boiler, that if it have 500 feet of surface, he shall have 350 feet to be acted upon by the fire; or this would be the extent of flue surface, supposing the surface of the whole boiler was 500 feet. These are facts deduced from experience, and not built on any plausible theory.

The Cornish expansion engine works on the well-known principle of the expansion of steam. The valve that admits the steam in the cylinder is shut, when the piston has performed about one-sixth of its stroke; and the steam that is in the cylinder expands and forces it the rest of the way. Steam of about 30 lbs. or 40 lbs. pressure on the square inch is used, and they also condense their steam. The engines now used at the Cornish mines, are most all of them on this plan. And from the Reports published monthly, some of the best of the Cornish engines do double the duty of those made on Boulton and Watts's plan. I will leave "A Young Engineer" to judge whether or not they are likely to supersede those on the old plan. They likewise will do all the duty required in a mine equally as well, and at half the expense of any others.

"N. M. T." The best work on algebra is a little book published by Souter, in Fleet Street, by Young. There are two parts of it, and the price is within every one's pocket. D. T.

TO CORRESPONDENTS.

Scientia.—*No paper has been received upon electricity, beyond that which was inserted in No. 98.*

G. F. Gibbs *can obtain the Index, &c., to Vol. V. at our Publishers.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 99, NEW SERIES. | SATURDAY, JULY 4, 1840. PRICE ONE PENNY. | No. 220, OLD SERIES.

FANO'S FIRE-ESCAPE.

Fig. 1.

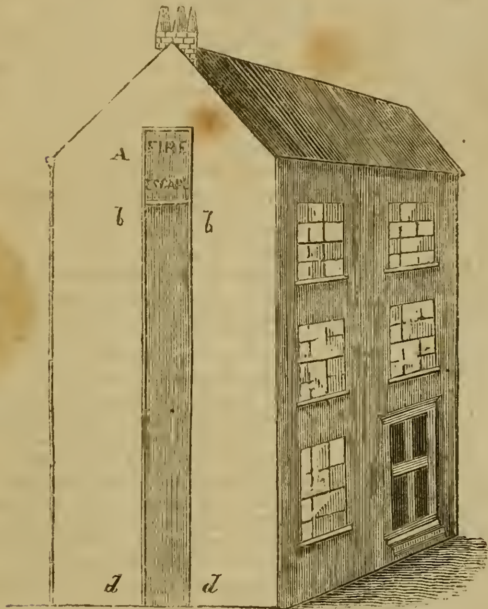


Fig. 3.

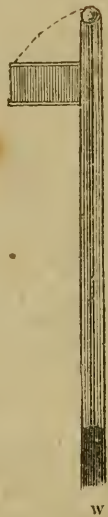
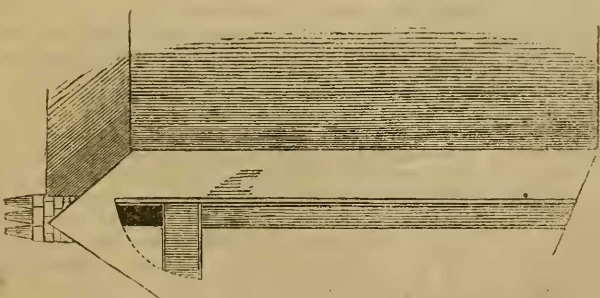


Fig. 2.



City Press 1, Long Lane, Aldersgate Street · D. A. Doudney.

FANO'S FIRE-ESCAPE.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—Having taken into consideration the dreadful calamities occasioned by that dangerous element, fire, I am induced to lay before the public a fire-escape.

Fig. 1 represents the side of a house (where generally there are but few windows); it is an opening in the wall, which is closed by a door; but instead of the hinges being as they usually are, they are at *b b*. When this door is opened, it presents a kind of balcony, as is shown in fig. 2, having railings round it; *b d*, *b d*, are grooves, in which this balcony can slide down. Now it is very evident, that if a man gets upon this balcony, his weight will cause it to slide downwards; but *w*, fig. 3, is a weight not quite equal to that of a man, so that when he gets off, the weight, *w*, will draw it up again, and another person may then take his place. The advantage of this may easily be perceived as regards females: should they faint, a chair can be placed for them; and not only this, but valuable property may be lowered at the same time. This fire-escape is meant more particularly for houses that are detached, and where no assistance can be obtained from the next dwelling.

I am, Sir, yours, &c.,

S. Fano.

PROSCRIPTION AND PUNISHMENT OF NATIVE GENIUS.

In all countries and in all times, inequality of rank and fortune has existed; and it is not only necessary, but, in the aggregate, beneficial to society that it should be so. If any legislature should decree that the lot of every individual should be alike, and all accumulation and transmission of property forbidden, the world would soon degenerate into one monotonous and uninterrupted gloom—no reward for merit, no encouragement to talent, and no stimulus to the most laudable ambition. In the present state of society, it is a lamentable fact, that vast numbers of working men, with their utmost endeavours, are unable to obtain any comfort beyond the absolute necessaries of life; their whole time is taken up with labour and repose, without an hour to devote to intellectual improvement, or even the cultivation of those arts which might enable them to excel in their particular trades, and thus materially improve their social condition. It concerns the statesman as much as the philanthropist, to promote, in every possible way, the well-being of the productive classes; but those who, by their clamour and exaggeration, add discontent to other inevitable evils, neither are, nor intend to be the poor man's friend. It needs neither the refinement of logic, nor the vehemence of invective, to make an ill-paid workman sensible of his hardships; but more extensive experience and circumspection may enable a well-meaning public writer to suggest such remedies as may gradually and permanently improve his condition. The remedy we propose, is no quack nostrum, no untried theory, but the result of long experience, confirmed by constant observation up to the present day—it is *instruction*, useful and appropriate instruction. Knowledge is not only power, but riches and virtue; and ignorance begets misery, which corrupts and dissolves into a mass of vice, and engenders the most revolting crimes that disgrace society. This is so manifest, that there cannot be two enlightened opinions upon the subject; but the means of dispensing this vital instruction is not quite so clear: little or nothing can be expected from the legislature. Our numerous endowed establishments are almost all taken from the people for whom they were intended, and given, in misplaced charity, to the rich; and private schools are either too expensive for poor families, or the instruction they afford is inadequate even to the slender wants of an artisan's child. The poor man has, therefore, but one resource—he must instruct himself; the means of doing so are multiplying every day; and it is easy to foresee, that mutual and popular instruction will distinguish the next generation above all preceding ages.

There are two means of inducing men to seek the acquirement of information, which must be apparent to every one who reflects at all upon the subject; one is, to render its attainment easy and agreeable, as is done, to a great extent, in the various mechanics' institutions, and other societies of a similar tendency; the other is to secure to the poor man the solid pecuniary advantages to which talent, developed and fostered by study, is, in justice, entitled. Our present object is, to show how shamefully the poor man is defrauded of his right to reap the harvest which his own unassisted labour and talent bring to maturity. It may sometimes happen, that a valuable discovery may be the result of accident; but most of the important improvements which have been

introduced into various descriptions of machinery within the last half-century, have cost the inventers much study, time, and anxiety, and, very often, considerable pecuniary sacrifice. The poorest class of mechanics, as we before observed, are unable, *in their present condition*, to devote their time or their money to the pursuit of speculative projects; and few of them possess sufficient knowledge to direct their efforts with advantage towards the attainment of any useful object, even if the impediments which poverty throws in their way, could be removed. We, therefore, at present, speak only of those who can, and do invent things serviceable to society, and who are the victims of oppressive laws, which deprive them of all participation in the benefit they confer upon others. Let any poor man invent an article, or process, or an improvement, which, if secured to him by a protecting law, would be productive of great advantage, and, perhaps, procure him a station in a higher rank of society; he is probably unacquainted with the ruinous details of the patent laws, and must, therefore, have professional advice. He applies to some lawyer or agent, and is informed that he must be prepared to pay 300*l.* or 400*l.* for the *chance* of securing a patent, for which information he is charged 6*s.* 8*d.* He complains of the hardship and injustice of so extortionate and monstrous a law, and Mr. Snap replies, "*Dura lex, sed lex*;" which, being Latin, is charged 13*s.* 4*d.* Mr. Snap then proceeds to expound the sentence—"It is, indeed, a very hard law, but still *it is the law*." For this translation he charges 6*s.* 8*d.*, making, together with 5*s.* for writing out the bill, 1*l.* 11*s.* 8*d.* He then applies to a monied man for assistance; and, after having divulged the whole of his secret, is most likely either refused, or, which is still worse, held in anxious and painful suspense, till, at last, he communicates his invention to some speculator with a Macintosh conscience, who appropriates it to his own profit, and, perhaps, realizes a fortune; while the unfortunate inventer, disheartened by long disappointment, and impoverished by loss of time and money, returns, with a heavy heart, to his daily toil, cursing the cruel patent laws, their makers, and their administrators. It is utterly useless for my Lord Brougham to propose alterations and amendments in the present law; he might with as much success attempt to prune and cultivate the deadly nightshade, or the poisonous henbane; we want the total abolition of the present law, and the substitution of another which shall protect, encourage, and reward merit. Then, and not till then, will the English artisan display the full powers of his genius, and universal instruction flourish throughout the country, whether aided by, or in spite of the policy of Government.

TEETOTAL INSTRUCTIVE INSTITUTE.

He who subscribes his hundreds of pounds for the education of the poor, merits the esteem and respect of his fellow-citizens, as an undoubted benefactor to society; but the great cause of educational reform gains more by the establishment of institutions tending, like the present, to create a desire, and facilitate the means of obtaining instruction applicable to the wants of the now uneducated classes. By the introduction of lectures, which are made attractive and interesting even to persons of good education, all feeling of humiliation is removed; and the small amount of contribution is well bestowed in rendering the members independent of all favours.

It is not our intention, at present, to discuss the merits of teetotalism at length, but we take the liberty of offering a few friendly remarks to the members of that Association. It has been objected to this system, that, in renouncing the excess of drinking too much, they have fallen into another equally extravagant excess—that of not drinking at all (i.e., of strong liquors); that while they discourse upon the little nourishment contained in a pint of ale, they forget that the analysis of their own tea and coffee would give an equally sorry result; that even horses, whose stomachs are not excited by habitual excess to a morbid craving for strong drink, are much relieved and invigorated by taking a couple of pints of good strong ale when they are suffering from fatigue: they say, that if barley were intended for making barley-water, hops were also made by the same beneficent Power, to impart a pleasant and wholesome flavour to it; that grapes were not created to give children the belly-ache in autumn, but to yield that inspiring juice which warms the heart, expands the mind, disperses melancholy, promotes good fellowship, and cements the most sacred bonds of friendship. We should not reject the gifts of a bountiful Providence, because some indulge in ruinous excess—an excess by no means flattering to human nature, and which brings with it its own appropriate and inevitable punishment. To rational beings, these

arguments, and many more that might be adduced, will have some weight—especially as they are sanctioned by the practice of all ages, from the remotest period recorded in history, up to the present time. Unfortunately, however, it happens, that all men are not rational, and it is found that the *abuse* of inebriating liquors begets a desire for still greater and more fatal excess; and an inconceivable phrensy impels those who are least able to afford the loss of time, money, and intellect, to abandon themselves to unbridled indulgence in the degrading, brutalizing, and destructive practice.

It is related of Sir Mathew Hale, that in his youth he frequented a society of profligate reprobates and drunkards; and being extremely shocked by the sudden and awful death of one of his companions, in the midst of a scene of riot and debauchery, he immediately retired, and took a solemn oath that no wine, or other intoxicating drink, should ever again pass his lips. He kept his word, and attained the high office of Lord Chief Justice of the King's Bench, and left a name which will be celebrated for wisdom and integrity as long as the history of our country is preserved. No one ever thought of ridiculing Sir Mathew Hale for his abstinence, although he was, to all intents and purposes, a teetotaller; nor does Byron's Corsair appear ridiculous, though also a teetotaller; how comes it, then, that so much contumelia and ridicule are heaped upon the teetotallers of the present day? We believe the whole secret to be in their injudicious adoption of a silly *sobriquet*, which suggests the idea of something vulgar and ridiculous; and we are certain that we are giving them good and sound advice, when we recommend them to assume a title more dignified and more English than that by which they are at present known.

The following is from the prospectus issued by the directors of the Institute:—

"The principle adopted by teetotallers, in abstaining from intoxicating drinks, is one of the most important steps towards the attainment of a large portion of real happiness. Enjoyments of an intellectual kind are, among the middle and working classes, chiefly to be attained by the teetotaller. Yet, mere abstinence from intoxicating drinks is but a mean to an end. The principle, however, is natural, and will, therefore, have the assistance of the Author and Supporter of nature. Although all this be true, yet every individual who has signed the charter of his freedom from the slavery of the drinking customs of society, has new habits to commence; and if those habits are not productive of a large amount of real and self-evident advantage to him, either of a physical, an intellectual, or a moral kind, the community is not benefitted to the utmost amount which is practicable by the change.

To aid, then, in this new state of society, which teetotalism does, and inevitably must yet farther produce, measures must be adopted to meet the growing demand for mental improvement and legitimate relaxation. This Association proposes to use all its energies to give a right direction to the thinking powers of the above classes, keeping in view the greatest of all principles—'Glory to God in the Highest—good will to man—peace on earth.' They intend to endeavour to accomplish these objects, by creating the means of attracting individuals to the improvement of their mental faculties, and to the pursuit of physical and intellectual science.

The means to be employed in effecting such objects, are intended to be, in the first instance, public and private lectures of the most useful description, interspersed with musical selections, both of a sacred and highly intellectual description. Occasional discussions and illustrated lectures on the most useful of the sciences, embracing every subject of real advantage to the greatest number, but always excluding party politics and sectarian religion. The admission to be by tickets.

The directors, therefore, invite every teetotaller who desires to connect rational enjoyment with solid improvement, to become a member, the expense being within the power of all.

To parents and guardians, the Institute presents advantages of such a nature, as will aid them in the development of the powers of youth, towards the attainment of every truth that can raise the tone of intellectual intercourse, and render life happy and useful.

And to all who desire to ameliorate the condition of the great majority of our population by literary and intellectual pursuits, and by innocent recreation, this Institute will present features of peculiar advantage."

ADULTERATION OF SOAP.

Most of our readers are, doubtless, aware, that a patent was granted several years ago, for a process of making spurious soap from burnt flints, and ingeniously imposing upon the public, and cheating poor washerwomen by Act of Parliament. The following is extracted from a report

of the Commissioners of Excise on the specific gravity of soap :—

"With regard to silica and clay soap, the experiments made by the writer of this report are not sufficiently numerous to give the requisite information; but as neither the silica nor the clay contributes anything to the detergent qualities of the soap, but merely increases its weight, all such additions ought to be prohibited by Government. Suppose a pound of good soap to cost 6*d*., and that another soap, containing twenty per cent. of silica or clay, is sold at 4⅘*d*., the two will be exactly of the same value; for four pounds of the good soap will go as far as five pounds of the adulterated soap. If the manufacturer charges 5*d*. for the pound of the adulterated article, he overreaches his customers to the extent of a farthing per pound. If this apparent cheapness have a tendency to increase the sale of soap, it operates as a premium to induce manufacturers in general to adulterate the article. The great extent to which the trade of Great Britain has reached, was originally founded on the goodness of the articles manufactured. The present rage for cheapness has a universal tendency to adulterate every article exposed for sale; and, unless it is counteracted by a vigilant Government, it must terminate in the destruction of the foreign trade of the country. The soap made for exportation is always of inferior quality; hence the monopoly of the French soap-makers, who supply Italy, Spain, and South America, with all the soap required by these extensive countries. If silica soap be permitted to be made, it ought to be charged according to its specific gravity, allowing it to contain twenty per cent. of silica, as the maker supposes it to do. Hence its specific gravity in the liquid state ought to be 1.3191. Hence a pound of it will have the bulk of 21.016 cubic inches; or it ought to pay one-fourth more duty than common yellow soap. In what is called clay soap, the clay is not at all combined with the alkali, no soap is formed with it; and its action is merely mechanical; and, in fact, it diminishes the power of the soap with which it is mixed in proportion to the quantity. The motives for mixing clay with soap are too obvious and too well understood to require any comment."

A Cold Lute.—Salt and whiting, properly kneaded with water, make a very hard and durable cement for many purposes, particularly for securing the joints of the apparatus for the production of carburetted hydrogen gas.

NELSON'S IMPROVED METHODS OF PREPARING GELATINE, &c.

(Continued from page 69.)

I shall now describe the method by which I prepare the gelatine, which I call my gelatine of the second quality, and, for the purpose of reference, I designate this method the third operation. In making this gelatine, I use any such glue-pieces as are hereinbefore mentioned, not being putrescent; and after they have been freed from hair or wool, flesh and fat, and are washed clean in cold water, I steep or soak them in a weak solution of acid other than sulphurous acid; and I prefer to use sulphuric acid, muriatic acid, or acetic acid, but I find sulphuric acid the most convenient; and I add acid to such solution from time to time, until the glue-pieces have an excess of acid. Any vessel may be used for this purpose, which will not be acted upon by acid. Or, instead of thus steeping or soaking the glue-pieces, I sometimes place them in a wooden closet, constructed in the ordinary method, to prevent the escape of gas, and there expose them to the direct action of sulphurous-acid gas produced by the combustion of sulphur within the closet, and continue them thus exposed to the direct action of such gas until they have an excess of acid. I ascertain whether the glue-pieces have an excess of acid, by testing them with litmus paper in the ordinary manner. So soon as they have such excess, I remove them from the solution, or from the closet (as the case may be), and put them into any convenient wooden vessels; and I keep them in these vessels, at a temperature of about 70° of Fahrenheit, about three weeks; I then put them into the steam-baths, and apply heat to these baths, in any convenient manner, until the glue-pieces attain a temperature of about 180° of Fahrenheit, and I keep up this temperature until the glue-pieces are entirely dissolved.

The liquid then formed is gelatine; and I then proceed to treat this gelatine in the same manner as I have already mentioned, in describing the method designated the first operation, after I have stated that the glue-pieces have been almost entirely dissolved, until this gelatine has been completely dried, and it is fit for use. In describing the method which I have designated the second operation, I have stated that a residuum of the cuttings remains undissolved. I use this residuum for the purpose of preparing the gelatine, which I call my gelatine of the second quality, in the manner hereinafter mentioned. After

this residuum has been separated from liquid gelatine, as hereinbefore mentioned, I put it into vessels constructed of wood or other suitable material; and while it remains in a heated state, I add to it, from time to time, diluted acid, not being sulphurous acid, until such residuum has an excess of acid; and I ascertain whether it has such excess, by testing it with litmus paper in the ordinary manner. I prefer to use sulphuric acid, muriatic acid, or acetic acid; but I find sulphuric acid the most convenient. This residuum, when it has an excess of acid, and the residuum which I have stated remains undissolved, in describing the method designated the first operation, as this last-mentioned residuum is separated from liquid gelatine, may be treated either alone or together, with such glue-pieces, having an excess of acid, as I employ in preparing my gelatine of the second quality, in all respects in the same manner as I have already pointed out or referred to, as my mode of treating such glue-pieces, in describing the method which I have designated the third operation. If the residuum or the glue-pieces which I have in preparing the gelatine, which I call my gelatine of the second quality, has been exposed to the action of sulphurous-acid gas or of sulphuric acid, I prefer to remove from them any excess of acid, by adding a suitable quantity of lime or carbonate of lime, to the liquid gelatine produced from them; immediately after, I remove such gelatine into the setting vessels, and in this case I allow such gelatine to remain undisturbed in the setting vessels, at a temperature not less than 100° of Fahrenheit, for a period of about twelve hours; I then remove this gelatine from the setting vessels, in the manner which I have already described; and I pour it upon the cooling slabs, as already pointed out and allow it to remain upon these slabs, until it becomes cold, and sets into a firm substance; I then cut it into pieces of a convenient size, and dry it on nets, by exposure to a current of cool dry air; and when it has been thus completely dried, it is fit for use. The gelatine, which I prepare by any of the methods hereinbefore mentioned, has the properties of, or resembles glue, and may be applied to all the purposes for which gelatine is commonly used, under the name of size or glue; but my gelatine of the first quality may also be applied to culinary purposes.

THE CHEMIST.

ON ALKALIES.

(Continued from page 70.)

NICOTINA (Vegeto).—This alkali is a peculiar principle, obtainable from the seeds and leaves of the tobacco plant, by infusing them in acidulated water, evaporating the solution to a certain point, then adding lime; distilling and treating the product that comes over with ether. It is colourless, has a pungent smell, and an acrimonious taste; volatile at 212°, and remains liquid at 20° Fahr.; mixes in all proportions with water, but is, in a great measure, separable from it by ether, which dissolves it abundantly. It combines with acids, forming salts, which are acrid and pungent like itself. The tartrate, phosphate, and oxalate, are readily crystallizable. It is very poisonous; "a single drop of it being sufficient to kill a dog."

Potassa (Vegeto and Earthy) is chiefly procured by lixiviation from the ashes of burnt wood and other vegetable substances, weeds, &c. The following table is founded upon the experiments of Kirwin, Vauquelin, and Pertuis; it contains a statement of the quantity of potashes afforded by some common trees and plants:—

10.000 parts of	Poplar	7
	Beech	12
	Oak	15
	Elm	39
	Thistle	53
	Vine	55
	Fern	62
	Cow Thistle	196
	Beans	200
	Vetches	275
	Wormwood	730
	Fumitory	760

The water, after having passed through the ashes, is called the "ley." This is evaporated in iron pans or pots (hence the term potash, which the present nomenclaturists have converted into *potassa*) to dryness; two or three are generally used. As fast as the ley is concentrated, it is passed from one to the other. By this means much time is saved, as the weak leys evaporate more quickly than the strong ones. The salt thus procured is of a dark colour, and contains much extractive matter. It is then carried to a reverboratory furnace, in which the extractive matter is burnt off, and much of the water dissipated. In this operation it loses from ten to fifteen per cent. of its weight. The salt thus purified, is called pearlash in commerce. To obtain potassa

chemically pure, recourse must be had to either the bicarbonate, nitrate, or tartrate of potassa; for instance, the bicarbonate having been ignited in a silver crucible, is to be dissolved in six times its weight of water; the solution is then to be boiled for one hour along with one pound of lime, for every pound of the salt used. It must then be left to settle out of contact of air. The supernatant liquor is then to be drawn off by a siphon, and evaporated in a clean iron or silver vessel, provided with a small orifice in its close cover for the escape of steam, till it assumes the appearance of oil, or till it be nearly red hot. It is then to be poured out upon a bright plate of iron, cut into pieces as soon as it concretes, and put immediately into a bottle provided with a well-ground stopper. Thus purified, it is a hydrate of potassa. It is white, very acrid, and corrosive: at a bright red heat it is volatilized. It is decomposed in contact with charcoal at a white heat. It quickly absorbs moisture from the air. When touched with damp fingers, it has a soapy feel, in consequence of its action on the skin. It dissolves sulphur, alumina, and silica. It forms a various class of salts with acids; the most important of which is the nitrate (or saltpetre). This alkali was of the first that was decomposed by Sir Humphrey Davy; he found it to consist of—

	Davy.		Dr. Ure.
Potassium	85	..	83.34
Oxygen	15	..	16.66
	100		100.00

Pure dry potassa can only be obtained by burning the metal potassium in pure and dry oxygen gas.

Quina or *Quinine* (Vegeto) and cinchonia, are two alkalies that exist in Peruvian or Cinchona bark; the former is most abundant in the yellow bark, while the latter is in the grey. The method of extracting quina from the yellow, is precisely the same as for obtaining cinchonia* from the grey bark. Quina is white; has an alkaline reaction upon the proper tests. It forms distinct salts with acids. The sulphate has the remarkable property of becoming luminous, when heated to a temperature of 100° Fahr., more especially if slightly rubbed. It is soluble in ether and alcohol, but slightly in water. It has an exceedingly bitter taste, if dissolved in dilute sulphuric acid. According to a recent analysis of M. Liebig, it is composed of—

Carbon	75.76
Hydrogen	7.52
Nitrogen	8.11
Oxygen	8.61
	100.00

* See page 292, Vol. V.

MISCELLANEA.

OLD RECIPES.

To Remove Wrinkles from the Face.—Make an iron shovel red hot; throw thereon some powder of myrrh; receive the smoke on your face, covering the head with a napkin, to collect the smoke and prevent its being dissipated. Repeat this operation three times, then heat the shovel again, and, when fiery hot, spout on it a mouthful of white wine. Receive the steam of the wine also on your face, and repeat it three times; and, by repeating this operation every night and morning, you will soon remove the complaint.

To Remove Corns from the Feet.—Roast a clove of garlic on a live coal, or in hot ashes; apply it to the corn, to which it must be fastened by a piece of cloth, and administered when going to bed. In the morning wash the foot with warm water, and the horny tunic of the corn will disappear. It is right to renew this application for two or three nights.

To Quicken the Growth of Hair.—Dip the teeth of your comb every morning in the expressed juice of nettles, and comb the hair the wrong way, and it will surprisingly quicken the growth of the hair.

Remedy for Decayed Teeth.—Make a balsam with a sufficient quantity of honey, two scruples of myrrh in fine powder, a scruple of gum juniper, and ten grains of roach alum. Frequently apply this mixture to the decayed tooth.

To make the Teeth look White.—Rub them well with nettle or tobacco ashes, or with vine ashes and a little honey. G. F. Gibbs.

Yellow Sympathetic Ink.—Dissolve an ounce of sulphate of copper (blue vitriol), and another of muriate of ammonia (sal ammoniac) in six ounces of water, diluting it gradually with more water, till it ceases to leave a visible trace upon paper. This ink is invisible when dry, but appears of a beautiful yellow, by heating the paper, and disappears when the paper is cool.

To make Gunpowder.—Take four ounces of refined saltpetre, one ounce of brimstone, and six drachms of charcoal; reduce these to a fine powder, and continue beating them for some time in a stone mortar with a wooden pestle, wetting the mixture with water, so as to form it into a uniform paste, which is reduced to grains, by passing it through a wire sieve; and, in this form, being carefully dried, it becomes the common gunpowder.

To make a Lead Tree.—To a piece of zinc fasten a wire, crooked, in the form of the worm of a still; let the other end of the worm be thrust

through a cork. You then pour spring water into a vial or decanter, to which you add a small quantity of sugar of lead; thrust the zinc into the bottle, and, with the cork at the end of the wire, fasten it up. In a few days the tree will begin to grow, and produce a most beautiful effect.

To produce Cold.—Take a small vial in one hand, containing some pulverized muriate of ammonia, pour a little water upon it, and shake the mixture, when a sensation of cold will be produced.

The Electrical Fountain.—Suspend a vessel of water from a brass arch, and place in the vessel a small tube. When electrified, the water will be one continued stream; and if the electrification be strong, a number of streams will arise in the form of a cone, the top of which will be at the extremity of the tube. This experiment may be stopped and renewed as if at the word of command.

To produce Gas Light on a Small Scale.—Take a tobacco-pipe, and nearly fill the bowl with coal dust, and then stop up the bowl with a cement made of beer and sand; then place the bowl in a fire between the bars of the grate, so that the pipe may stand nearly perpendicular; in a few minutes gas will escape from the orifice of the pipe, when, if a light be applied, it will take fire and burn for several minutes with a small but clear flame.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 8, W. Maugham, Esq., on Voltaic Electricity. Friday, July 10, T. Adams, Esq., on Music. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, July 9, Mr. W. H. J. Traice, on the Comedy of "As You Like it." At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 8, Mr. Gaze, on Pneumatics. At eight o'clock.

QUERIES.

How to prepare wash-leather; and how to make a good, but cheap bleaching powder?

E. GARRETT.

Being about to fit up a camera obscura, I shall feel obliged if any of your optical correspondents will answer the following questions:—The mirror is 9 in. by 12 in.; the lens, $6\frac{1}{2}$ diameter, plano-convex; the focus, 4 ft. What will be the diameter of the image it will throw, and what will be the radius for curve of the table?

S. C.

A receipt for manufacturing purple and blue ink?

A. CLERK.

[Several good receipts for making blue ink have appeared in the "Mechanic." See page 176, Vol. IV.—ED.]

The best means of cleaning and restoring wall papering?

H. S.

How to make a velocipede on the best principle? Also how to make crimson and other coloured stars for Roman candles, &c.? The receipts already given in the "Mechanic" for coloured fires, will not suit my purpose.

A YOUNG EXPERIMENTALIST.

ANSWERS TO QUERIES.

To make Bottle Lemonade.—Dissolve half-a-pound of loaf sugar in a quart of water, and boil it over a slow fire; two drachms of acetic acid, and four ounces of tartaric acid; when cold, put twopennyworth of essence of lemon. Put one-sixth of the above into each bottle filled with water, and put thirty grains of carbonate of soda, and cork it immediately, and it will be fit for use.

A. Y. E.

To Purify Quicksilver.—By distillation in iron retorts.

To make Sulphuretted Hydrogen.—Melt together in a crucible three ounces of iron filings and one ounce of sulphur; reduce the mass to powder, and put it with a little water into a gas-bottle with two mouths. In one of the mouths insert a tube (run through a cork), bent in such a manner as to convey the gas into whatever vessel is wanted to contain it; into the other mouth pour some diluted muriatic acid, and stop it immediately. The gas will now be disengaged in large quantities through the other tube.

B. MOUNTFORT.

TO CORRESPONDENTS.

J. Barry.—*We are not in possession of the address of the correspondent who favoured us with the description of a vertical saw frame in No. 88, N.S.; but we trust he will oblige us with a more detailed account of his invention, as he has offered to do.*

S. C. *is mistaken in his remarks on the astronomical question. A celestial phenomenon may occur, which is visible nearly at the same instant at different places; but the nominal time varies with the longitude, a circle of the earth being equivalent to twenty-four hours. The real difference is caused by parallax.*

B. Mountfort.—*His explanation is sufficiently clear without the drawing. It is desirable that drawings intended for engraving, should be accurately executed, and of the proper size; as it causes unnecessary inconvenience and expense to enlarge or diminish the scale.*

R. P. Batger.—*The notices of lectures came too late for insertion. We shall be happy in future to publish them, and otherwise to promote the good cause for which the Institute is established.*

W. H. Hewett *will find some letters addressed to him at our office, Long Lane.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

No. 100, NEW SERIES. | SATURDAY, JULY 11, 1840. PRICE ONE PENNY. | No. 221, OLD SERIES.

BROWN'S PATENT FIRE-PLACES.

Fig. 1.

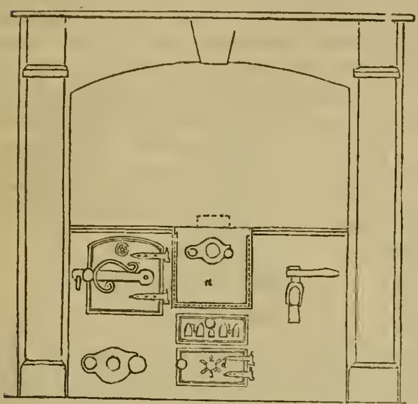
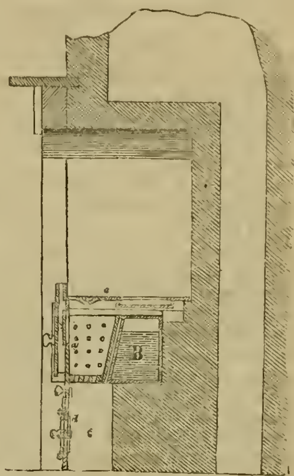


Fig. 2.



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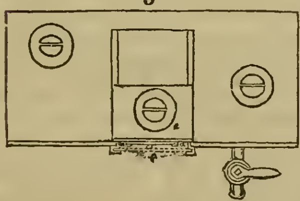

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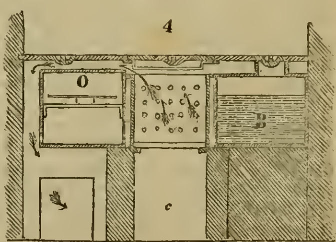


City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

BROWN'S PATENT FIRE-PLACES.

(See Engraving, front page.)

My invention relates to a mode of constructing the fire-places of such description of stoves as are called cooking-stoves or ranges, and consists in so arranging the fire place, that the process called roasting may be performed by means of a heated plate in front of the fire-place, thus enclosing the fire, whereby not only is the process of roasting more advantageously performed, but that the heat of the fire economised in the fire-place for performing the processes of baking and boiling. And, in order to give the best information in my power, I will proceed to describe the drawing hereunto annexed.

Des ription of Engraving.

Fig. 1 is a front view of a cooking-stove or range with the fire-place, and parts connected therewith, constructed according to my invention.

Fig. 2 is a transverse section.

Fig. 3 is a plan of the top of the stove or range; and

Fig. 4 is a front section. In each of these figures, the same letters indicate similar parts.

An iron plate, *a*, is substituted instead of the ordinary front fire-bars, before which roasting is performed in a very superior manner, owing to the regularity of the heat produced, and entire freedom from dust and ashes. The whole surface on the top presents an extensive hot plate. The fire is thus entirely closed. The boiler forms the back and one side of the fire-place, the other forms the opposite side, which are protected by thick cast-iron plates. The whole heat produced being thus confined, is applied for all the purposes of cooking; and it will be found that a very small proportion of fuel is requisite, compared with the quantity used in the fire-places of ordinary cooking-ranges. Near the top of the roasting-plate (above the body of the fire) a small door is introduced, which gives this stove the advantage of an enclosed fire for cooking; and when not required for that purpose, the door may be opened, affording the comfort of an open fire combined with a saving in fuel; for it will be evident, that nearly the whole of the draught admitted, passes over the fire, which has a tendency to check the effect of the draught of air admitted below; a greater supply of hot air is also produced, which passes entirely round the oven, consequently less fire is requisite for baking. Below the roasting-plate are some gothic openings; *b b*, in which talc is introduced, to show by reflection the state of the fire; beneath these openings is the ash-hole, *c*, which is also enclosed; the draught is admitted to the fire through a ventilator, *d*. On the top is a sliding-plate, *e*, where the fire is supplied with fuel. The boiler is fixed upon solid masonry, and requires no other heat than that which it receives from the back and side of the fire. The heated air passes over the oven, it then descends on the opposite side, and passes under the oven into the flue, as is clearly indicated in the drawing; the oven is thus constantly heated in a very superior manner, the heat being more regular than in the ordinary mode of fixing them. The roasting-plate is enclosed b a moveable front, *f*, on the top of which is a small socket, the bottom being left entirely open, a current of air is produced between the two plates; thus a considerable portion of hot air is generated, which, if required, may be conducted to any part of the house. If the hot hair is not required for any purpose, it may be conducted into the chimney. This will be found very advantageous during the summer season, when the convenience of a fire is required without the inconvenience of the heat produced thereby.

ON ELECTRICITY.*

NO. IV.

What is electricity? Electricity is a fluid of which we know nothing, except from its results; a fluid which pervades the surface of every material substance. It pervades our houses, bodies, clothes, the air we breathe, and, in fact, the whole of nature. But why, it may be asked, do we not perceive it; why are we not sensible of its presence? I answer, because it is in a state of equilibrium. Although every substance possesses a certain quantity of this fluid, yet it remains perfectly quiescent till its equilibrium is disturbed. or, in other words, till it possesses more or less than its natural quantity. But as soon as this is the case, its presence can immediately be detected. To illustrate this, take a stick of sealing-wax and woollen cloth, both of which substances possess a certain quantity of electricity, which is in a state of equilibrium; but as soon as these are rubbed together, the equilibrium is destroyed by the friction;

* This paper was by mistake omitted in its proper place; it should have appeared after No. 2, page 297, Vol. V.

a portion of the electric fluid immediately leaves the wax, and enters the flannel; the wax then possesses less, and the flannel more than its natural quantity. Now hold either the wax or flannel over a few light substances, such as strips of paper, pieces of cork, &c., and they will immediately be attracted by it; and attraction is the sign or evidence of the presence of this fluid. It is evident, then, by this experiment, that we obtain or accumulate electricity and detect its presence, by means of friction between two substances (by rubbing the sealing-wax and flannel together); and this process is what electricians term excitation. All bodies do not naturally possess this property; those which do, are termed electrics; those which do not, non-electrics. The following is a table of the principal electrics and non-electrics:—

ELECTRICS.	NON-ELECTRICS.
Silver	Shell-lac
Copper	Amber
Lead	Resins
Gold	Sulphur
Brass	Wax
Zinc	Glass
Tin	Diamond
Platina	Raw Silk
Iron.	Dyed Silk.

A farther difference likewise exists between electrics and non-electrics; the former possessing the power of insulation, while the latter, that of conducting electricity; both which properties are exactly the reverse of one another, and, therefore, cannot be united in one and the same substance. Insulation is that peculiarity of bodies, which enables them to impede the passage of electricity. This fluid has, like water, for example, naturally a tendency to spread itself in all directions, and, therefore, it would be impossible to collect it for the purposes of experiment, except there were some means of confining it; and this is afforded by means of electrics or insulators. Glass, among others, is an insulator; and it is for this reason that we let the prime conductor of the machine rest upon a pillar of that substance, when we wish to accumulate electricity in the conductor, and for this purpose oppose an insulator between it and the ground. We can thus obtain a strong shock, when the machine is in action, which would not happen, did not the pillar of glass prevent its escape.

The property of conducting bodies is exactly the reverse of this; they do not impede, but, on the contrary, carry away the electric fluid. In illustration of this, place a chain upon the prime conductor of the machine, and communicate it with the ground, then turn the machine, and not a single spark can be obtained; the electric fluid being carried or conducted away by means of the chain.

We have before stated, that if a tube of glass, or stick of sealing-wax, be rubbed with a piece of dry silk or woollen cloth, that it acquires the property of attracting light bodies. These bodies, after they have been for a short time in contact with the electric, are then repelled by it; and if the electric be again presented to them before they have touched the earth, or any other conducting body, they will be farther repelled; if they have, they will again be attracted.

(To be continued.)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 21.)

Coventry is a city of great antiquity, 91 miles from London, 18 from Birmingham, 10 from Warwick, and five from Kenilworth. It was formerly written *Conventria*, or *Conventry* (from a convent which was founded there at a very early period, long before the Conquest), and the ancient British *Tree*, a town. It is a borough, city, and county of itself, but *locally* in the county of Warwick. The chief parts of the city are seated on a gentle acclivity, and watered by the Radford and Sherbourn brooks. Coventry was formerly surrounded by walls three miles in circumference, of great strength, and fortified with thirty-two towers. This work was commenced in 1355, and completed in about forty years. In the reign of Charles II., the wall and towers were demolished with the consent of the citizens, and the town thrown open. Most of the gates were, however, spared; but only three out of twelve now remain, and those of a subordinate character, and in a dilapidated condition. Some remains of the wall may still be traced in several districts, but they are fast disappearing. Notwithstanding numerous modern improvements, many of the streets are narrow and badly paved, and the houses from three to four centuries old, presenting an aspect more gratifying to the antiquarian, than flattering to the taste and judgment of our ancestors. Coventry has been singularly fortunate in escaping from fire; not a single conflagration of any considerable extent having occurred for centuries past;

as is attested by the old projecting pestiferous houses which still exist in the various districts of the town, or have been purposely removed, to make room for more spacious streets and commodious houses. There are three churches—St. Michael, Trinity, and St. John. *St. Michael's* is a superb structure of the fourteenth century, in the Gothic style of architecture. The tower is 136 feet in height, and surmounted by an elegant octagonal spire, altogether 300 feet high. The windows of the upper story, which range along the whole of the sides, are decorated with ancient paintings of religious subjects. The ceiling is of oak, ribbed and carved. *Trinity Church* is contiguous to St. Michael's ; it is a handsome cruciform building, though inferior in elegance and grandeur to its stately companion. *St. John's* is also a cruciform structure, with a square embattled tower and round turrets. There are some other important buildings in this town, among which, *St. Mary's Hall* is particularly deserving the attention of the antiquary. The historical events connected with Coventry, are both numerous and important; but it would exceed our limits even to enumerate them. The legend of Lady Godiva is pretty generally known throughout England ; but it is not so universally known, that the whole story is a fabrication without any foundation in truth. A procession in honour of Lady Godiva was, till within the last thirty years, paraded through the town every year ; it consisted principally of St. George of England on his charger, and a lady representing Lady Godiva, followed by the Mayor and corporation, &c. This ceremony was first instituted in 1677, in the reign of Charles II., about 600 years after the time of Godiva. In Gough's edition of Camden's *Britannia*, it is stated that Mathew of Westminster, who wrote in 1307, that is, nearly two centuries and a half after the time of Leofric and Godiva, is the first who mentions this legend ; and many preceding writers who speak of Leofric and Godiva, do not mention it. The invention of this story was probably suggested by an inscription in Trinity Church, where a picture of Leofric and his lady was set up about the time of Richard II. He is represented holding a scroll with these words :—

I, Luriche, for love of thee,
Doe make Coventre toll free.

The legend itself is too well known and too foolish to require repetition.

DR. TURNBULL.

Some months have now elapsed since we have introduced the worthy doctor to our readers. A case, however, having just come under our notice, we cannot forbear mentioning it. Accidentally meeting a young lady the other day, who it appears had for some considerable time been labouring under the painful malady of deafness, we strongly advised her to pay a visit to Russell Square, and try the skill of Dr. Turnbull. Having sought the assistance of several of the most reputed physicians of the day, to little or no purpose, she appeared at first somewhat reluctant to do so; but an assurance of his very general success, having at length overcome her objections, she was induced to wait upon the doctor. She has paid him, we believe, but three visits ; and we have the pleasure of informing our readers, that she called upon us this day, on her way to Dr. T., so far restored as to betray little or no symptom of a want of hearing. Another case we may just mention—that of a very near relative. For ten or twelve years she had been exceedingly deaf, so much so that she very rarely heard a public speaker, and in a room could only converse with any degree of freedom, by means of an Indian-rubber tube. Every measure that could be adopted had been adopted, to regain her hearing, but in vain; almost every physician that could be consulted, had been consulted, but in vain; and her case was considered a hopeless one, when she first heard of, and called upon Dr. Turnbull. Upon her first visit, he said she would not again require the use of the Indian-rubber tube, before referred to; *she has never used it from that day to this.* And, though she has shown irregularity, and a great want of perseverance in her attention to the means prescribed, a great improvement has taken place. We have stated *the facts*—we leave these with our readers and the public generally, without comment ; presuming clearer and more satisfactory cases of Dr. Turnbull's skill, to be unnecessary.

PENNY-POSTAGE STAMPS.

To the Editor of the Mechanic and Chemist.

Sir,—Having observed, as, I believe, has every one, the ludicrous and even disgusting appearance which the portrait of our most gracious Queen presents on letters which have passed through the Post-office, I beg to suggest, as a means of avoiding this evil, that in printing the sheets of portraits, there be left between

each row of these a white space ; so that, on being cut out, each head may have a blank underneath it to receive the Post-office stamp. Moreover, the blank spaces between the lines of portraits, might easily be made to undergo such a preparation, as would preclude the possibility of the Post-office mark being effaced by any chemical process without detection.

Yours, most respectfully,

J. M.

Twickenham.

[We agree with our correspondent in condemning the present arrangements for stamping letters. The adhesive stamp is, at best, a most despicable production, and with the addition of the red stamp, it becomes hideous ; the engraved covers and envelops might do for a pot-boy's valentine, but it is an insult to the commerce of this country, to suppose that merchants will approve of such foolery in their correspondence. J. M.'s regret would kindle into indignation, if he were to see the beautiful models of stamps which have been rejected. The subject will be brought before the House of Commons very shortly, when the present regulations will probably undergo considerable alterations ; but it is not expected that any alteration will take place in the rates of postage.—Ed.]

RAPER'S PATENT IMPROVED WATERPROOF FABRICS AND LEATHER.

(*Abstract of Specification.*)

My improvements in rendering fabrics and leather waterproof, without obstructing air or perspiration, or imparting any unpleasant odour, consists of a mode of waterproofing fabrics and leather as hereafter described.

First, I prepare, in the following proportions, a fluid of one ounce of good gelatine to one quart of hot water, and a drachm and a half of carbonate of ammonia, or half-a-drachm of pure liquid ammonia.

Secondly, I prepare a concentrated solution of sulphate of soda, or of sulphate of potash, or of sulphate of ammonia, or of phosphate of soda.

Thirdly, I prepare a concentrated solution of acetate of lead.

Fourthly, I prepare the foregoing liquor for a bath. I triturate four pounds of fuller's-earth with half-a-pound of camphor in powder, and gradually stir these into forty gallons of pure or distilled water, and, before the precipitation of the fine particles, I draw off the liquor into a suitable vessel. The fabric to be waterproofed I immerse in the first fluid composition and dry it, and then I again immerse it in the second fluid or solution, and after a suitable time I remove it into the third fluid or solution, and from thence into the fourth composition or bath, where I recommend it to be kept immersed for some time, and then properly washed and dried, and afterwards dressed and pressed as cloth-dressers finish their cloths or fabrics.

From the foregoing description, aided by a little practice, the workman will readily be able to perform this invention, notwithstanding the varying nature of the different fabrics he has to operate on. And I would remark, that although I have been particular in thus describing the quantities of the various materials used, I do not confine myself thereto, nor to the salts above mentioned ; though I believe them to be the best for the purpose. And I would also remark, that although I recommend the using of the four liquors, it should be understood that the first and the fourth may be dispensed with, and yet produce a beneficial result in waterproofing fabrics and leather. I do not, therefore, confine my patent to the using all the four liquors, though I prefer to do so ; the object of the invention being to produce an insoluble compound in the fabrics or leather operated on by the employment of suitable salts.

WIESMANN'S PATENT PROCESS FOR MANUFACTURING ALUM.

(*Abstract of Specification.*)

My invention relates to a mode of manufacturing alum, by which the same may be produced free of iron and alkali, or nearly so ; and in order to give the best information in my power, I will proceed to describe the process pursued by me. I take potter's clay, as free from iron as possible, and calcine the same to a moderate red heat, in order, as much as possible, to drive off all humidity. The clay so calcined is next to be ground to a powder, and to be placed in leaden pans heated by a moderate fire, or by steam, and sulphuric acid (about 66° by Beaumé) is to be applied in sufficient quantities, that the acid may dissolve nearly the whole of the clay. I prefer that the whole should not be dissolved, as a saving of acid is thereby obtained. The mass in the pan is to be stirred until it is dry, when boiling water is to be applied, to dissolve the salt formed, and water is to be applied till the whole of the salt is separated ; the liquids thus ob-

tained, are mixed and placed in vats, and left therein till perfectly clear. A measured quantity of the liquor is to be tested with prussiate of potash, or other suitable material, to ascertain the quantity of iron contained in such measured quantity of the liquor; then the whole quantity of liquor being known, the quantity of iron therein may be obtained by calculation; and whatever be the weight of iron the liquor to be operated on is found to contain, an equal weight of prussiate of potash dissolved in water is to be stirred into the liquor, which will take to the iron, and they together will be precipitated; by this means the liquor, drawn off clear or filtered, will be composed of sulphuric acid, alumina, and water, and in this condition may be used for the purposes of the arts; but when required to be crystallized, I reduce the liquor by quickly boiling and strong evaporation. Evaporating it in large leaden vessels, until a skin of salt forms on the surface, when the liquor is drawn into shapes, where it cools and crystallizes. I would here remark, that I am aware that clay treated with sulphuric acid, has been employed in the process of making alum, but the processes have been conducted in a different manner, requiring much time, and producing alum not so pure and concentrated. I do not, therefore, claim the same generally, when practised according to the means heretofore known. And, although I prefer the employment of prussiate of potash for precipitating the iron, I do not confine myself thereto; as other materials may be used, such as the lixivium of blood, or sulphate of lime. But what I claim is, the mode of making alum from clay, as herein described, whereby the alum will contain much more alumine, and is free, or nearly free from iron.

ON THE INSECT TRIBES.

Naturalists have found it necessary to arrange insects into different tribes or families, distinguished from each other by certain peculiarities in the structure of their bodies; such as their having or wanting wings, and from the number and substances of which these instruments of motion are composed.

No other classes of animals have more legs than four; but most insects have six; and some have eight, ten, fourteen, sixteen, and even a hundred. Besides the number of legs, insects are furnished with *antennæ* or feelers. These feelers, by which they examine the substances they meet with, are composed of a greater number of articulations or joints. When a wingless insect is placed at the end of a twig, or in any situation where it meets with a vacuity, it moves the feelers backward and forward, elevates, depresses, and bends them from side to side, and will not advance farther lest it should fall. If a stick or any other substance be placed within the reach of the feelers, the animal immediately applies them to this new object, examines whether it is sufficient to support the weight of its body, and in that case instantly proceeds on its journey.

Though most insects are provided with eyes, yet they can see distinctly but at small distances; and of course must be very incompetent judges of the vicinity or remoteness of objects. The feelers, which are in perpetual motion while the animal walks, remedy this defect, and enable it to proceed with safety in the dark.

Some of the insect tribes have four, and others, as the spider and scorpion, have eight eyes. The eyes of insects are absolutely immovable; but this defect is supplied by a contrivance which renders them capable of viewing objects in every direction, and also of seeing bodies that are too minute to be perceived by us.

There is another peculiarity in the structure of insects. They have no bones: but that defect is supplied in some by a membranous or muscular skin, and in others by a crustaceous or horny covering. In this circumstance, insects resemble the shell animals, whose bones constitute the outward parts of the bodies.

The mouth of insects is generally placed in the under part of the head; but in some it is situated in the breast. The greater number of winged insects are provided with a proboscis or trunk—a machine of a very complicated nature, which serves them to extract the juices from plants, to conduct the air into their bodies, and to convey the sensation of smelling. The substance of the trunk has some resemblance to that of horn. It tapers from the base to the extremity, and is composed of two similar and equal parts (each of them concave), which, when joined, form three distinct tubes, that serve as a mouth, a nose, and a windpipe.—*Mavor.*

Freezing Mixture.—Dissolve five drachms of muriate of ammonia and five drachms of nitre, in two ounces of water; a thermometer immersed in the solution, will show that the temperature is reduced below 32°. If a tube filled with water be suspended in the solution, the water will be effectually frozen.

THE CHEMIST.

CHEMICAL ANALYSIS.

(*Continued from page* 71.)

6. AMMONIA, sp. gr. 0.5902; weight of 100 cubic inches 18.000 grs. Transparent, colourless, elastic, pungent smell; extinguishes combustion and animal life; acrid taste. Condensed by water, which dissolves one-third of its weight of the gas.

7. *Chlorine*, sp. gr. 2.500; weight of 100 cubic inches, 76.25 grs. Colour greenish yellow; peculiar smell and taste, which is not liable to be mistaken for any other gas. Inhaling of it causes a sense of strangulation. Supports combustion. Crystallizes at 40° Fahr.; the crystals are of a deep-yellow colour.

8. *Muriatic Acid*, sp. gr. 1.2840; weight of 100 cubic inches, 39.183 grs. Odour pungent; taste acid and corrosive; invisible; extinguishes combustion and animal life. It consists of chlorine and hydrogen in equal volumes; thus, 1 hyd. + 1 chlo.

8. *Sulphurous Acid*, sp. gr. 2.222; weight of 100 cubic inches, 67.77 grs. Absorbed by water at 61°; reddens and then destroys blue vegetable colours; taste acrid. Odour similar to that of burning sulphur.

10. *Sulphuretted Hydrogen*, sp. gr. 1.1805; weight of 100 cubic inches, 36.006 grs. Combustible; burns with a blue flame; odour resembling that of rotten eggs; taste sour; reddens vegetable blues; is absorbed by water, and deposits sulphur while burning.

11. *Nitrous Oxide* or *Protoxide of Azote*, sp. gr. 1.5277; 100 cubic inches weigh 46.6 grs. Respirable; taste sweet; agreeable odour; condensable by water; exhilarating; supports combustion.

12. *Nitric Oxide* or *Deutoxide of Azote*, sp. gr. 1.0416; 100 cubic inches weigh 36.77 grs. Water condenses about one twentieth of its volume of the oxide; is absorbed by the protomuriate or protosulphate of iron, forming a dark-coloured liquid; causes red fumes when exposed to the atmosphere. Extinguishes combustion and animal life.

13. *Carbonic Acid*, sp. gr. 1.5277; weight of 100 cubic inches, 46.596 grs. Is absorbed by water, which becomes afterwards acidulous; reddens vegetable blues; sharp taste; entirely destroys animal life, as well as the irritability of the muscles.

14. *Carbonic Oxide*, sp. gr. 0.9722; 100 cubic inches weigh 29¾ grs. Inflammable; burns with a dark-blue flame. Water condenses one-forty-sixth of its volume of the gas. Fatal to animal life if respired.

16. *Carburetted Hydrogen* or *Coal Gas*, sp. gr. 0.978; 100 cubic inches weigh 28.80 grs. Destructive of animal life; when pure, devoid of colour, taste, or smell; burns with a white flame.

17. *Hydriodic Acid*, sp. gr. 4.4; 100 cubic inches weigh 134.2 grs. Invisible; odour resembling that of muriatic acid.

18. *Chlorocarbonous Acid* or *Phosgene* of Dr. Davy, sp. gr. 3.4722; 100 cubic inches weigh 105.9 grs. Suffocating and intolerable smell; does not fume in the atmosphere; reddens vegetable blues.

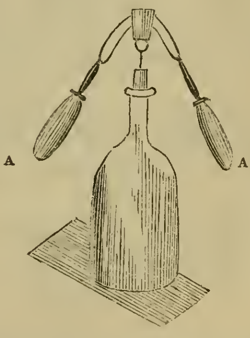
19. *Chlorous Oxide* or *Euchlorine*, sp. gr. 2.423; 100 cubic inches weigh 74 grs.; smell as of treacle; not respirable; yellow colour; soluble in water.

20. *Chloric Oxide* or *Deutoxide of Chlorine*, sp. gr. 2.361; 100 cubic inches weigh 77 grs. Deep-yellow colour; absorbed by water; astringent taste; destroys, but not reddens vegetable blues; explodes with phosphorus.

MANIPULATOR.

MISCELLANEA.

To make a Shilling turn on its Edge on the Point of a Needle.—Take a bottle, and insert in the mouth, a cork with a needle in a perpendicular position; then cut a nick in the face of another cork, in which fix a shilling; and into the same cork stick two table-forks, A A, opposite to

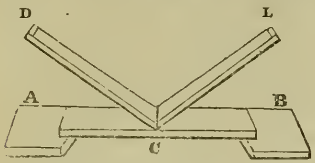


each other, with the handles downwards. If the rim of the shilling be placed upon the point of the needle, it may be turned round without any risk of falling off, as the centre of gravity is below the centre of suspension.

To make Artificial Magnets.—The best method of making artificial magnets is, to apply one or more powerful magnets to pieces of hard steel; taking care to apply the north pole of the magnet or, magnets, to that end of the steel which is required to be made the south pole; and the south pole of the magnet to the opposite extremity of the piece of steel.

Place two magnetic bars, A and B, in a line, so

that the north end of one shall be opposite to the south end of the other; but at such a distance that the magnet, C, to be touched, may rest with its marked end on the marked end of A. Apply the north of C, the opposite ends being elevated, as in the figure. Draw L and D asunder; one to

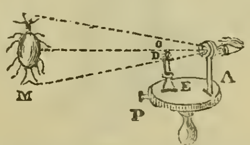


wards A, and the other towards B, and remove them a foot or more from the bar, when they are off the ends; then bring the north and south poles of these magnets together, and apply them again to the middle of the bar, C, as before. Repeat this process five or six times, turn the bar, and touch the other three sides in the same way, and with care, the bar will acquire a strong fixed magnetism.

Of Lenses.—Lenses are of different shapes, from which they take their names; they are represented here in one view:—*a* is a plano-convex, because one side is flat and the other convex; *b* is a plano-concave, one side being flat and the other concave; *c* is a double convex lens, because

both sides are convex; *d* is a double concave, having both sides concave; *e* is called a meniscus, convex on one side, and concave on the other.

The Single Microscope.—A is a circular piece of brass, in the middle of which is a very small hole; in this is fixed a double convex lens, the focal distance is O D; at that distance is a pair of



pliers, D E, which is adjusted by the screw, P; with these any small object may be taken up and viewed with the eye placed at the other focus of the lens at F, to which it will be magnified, as at I M. E. LEDGER.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 15, W. Maugham, Esq., on Voltaic Electricity. Friday, July 17, F. M. Innes, Esq., on the Present State and Future Prospects of the Australian Penal Colonies. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, July 15, Quarterly General Meeting. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 15, R. J. Jeffs, on Oxygen Gas. At eight o'clock.

QUERIES.

In No. 88, N. S., of your Magazine, a correspondent has given a plan and description of a vertical saw-frame; may I beg of you to give him a hint to fulfil his promise to those who would "wish to know more on the subject." I would wish to know what power is applied, and such particular information, as would enable any one of your readers to construct one similar to his own?

In No. 3, N. S., it is mentioned that a cement, which dries rapidly, is used for modelling buildings in pasteboard, called Indian glue; I would wish to know where it is to be procured, or how made? HENRY HILL.
Cork.

The right way to wind the copper wire round an electro magnet? J. B.

The best method of extracting oil from ivy berries? Also, how to prevent drawings from smearing? W. F. C.

ANSWERS TO QUERIES.

To find the Area of a Circle.—Multiply the square of the diameter by the square root of D, and divide the product by the square root of 3; thus:— $\frac{D^2 \times 2}{\sqrt{3}} = A$

If there should be any difficulty on account of this not exactly corresponding with the established rule, I shall then be ready and willing to clear it up, and, I believe, to your entire satisfaction. G. WADSWORTH.

Purified Animal Oil may be obtained of L. Rossi, No. 6, Everett Street, Russell Square. A. O. S.

TO CORRESPONDENTS.

T. Abel.—*The action of the eccentric is, theoretically, the same as that of the crank; but the friction is much greater. For the best and simplest construction of a velocipede, we must appeal to our correspondents, trusting that we shall be favoured with the description of one that has been tested by experience.*

M.'s *directions for finding the specific gravity of gases, are both obscure and inaccurate.*

H. O. P. E. *and* J. M. D. *in our next.*

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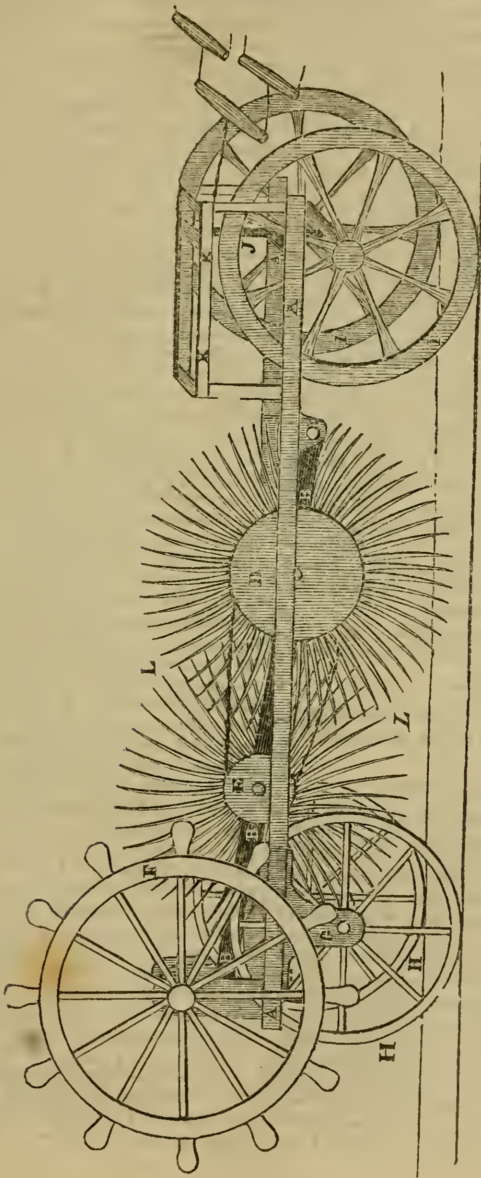
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 101, NEW SERIES. | SATURDAY, JULY 18, 1840. PRICE ONE PENNY. | No. 222, OLD SERIES.



VAUX'S PATENT PLOUGH.

City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

VAUX'S PATENT PLOUGH.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—I send you the annexed drawing and description of Vaux's patent plough, as, I believe, it has not been published, being a new invention. As I have not seen it tried, I cannot speak of its merits, but must leave you to judge. A A is an oblong frame work of cast iron, with a bearing, C, on each side for the frame, B B, on each side, which is raised or lowered, according to the nature of the earth, by a chain, and the wheel and axle, F; D and E are two wheels, with a chain running round them; D, the working wheel, which digs up the earth as the machine moves along, the irons of which are like the broad end of a pick-axe; the irons of the wheel, E, which makes two revolutions to D's one, are narrower, and are to break up the clods as D digs them up; the wheels, H H and I I, are to run on the ground; the axle of the wheels, I I, works on a centre, J, to allow the machine to be guided like a common four-wheel carriage; K, the frame for the centre, J, to work in; G, the bearing for the wheel, H, with a similar bearing on the other side. The irons on the two wheels are so disposed, that they pass between each other, as at L. The frame, A A, is about five feet long, and the width of it about three feet. The diameter of the axles of the spike wheels is six or eight inches. The machine is drawn by horses as in the old plough.

I remain yours, &c.,

W. SERVICE, JUN.

SPILBURY'S PATENT IMPROVEMENTS IN PAINTS AND VEHICLES, &c.

(Abstract of Specification.)

IN preparing and applying paints or pigments and vehicles, as at present generally practised for painting or coating surfaces therewith, various vehicles are employed; and when it is intended that the pigments or paints should be so fixed as to allow of being cleaned by washing with soap and water, the pigments employed are mixed with oil or spirit, or with oil or spirit varnishes; and it may be remarked, that from the circumstance of employing the abovementioned vehicles, many of the cheaper pigments, such as earths and others, cannot be used with advantage. And pigments are also often employed mixed with gelatine or size, and known as water-colours, colouring, and distempering; but when such mode of employing pigments is resorted to, owing to the vehicle being soluble in water, the paints, when applied to surfaces, are not so fixed as to allow of washing with water, or with soap and water, as practised when cleaning paints prepared with oils, or spirits, or varnishes produced therewith; consequently, although by such means of employing soluble vehicles, cheap as well as other pigments may be employed, yet, owing to these not being so fixed as to allow of cleaning, such application of paints or of pigments is not suitable for the better class of paintings, nor for the use of artists. We would here, however, remark, that we are aware that it has been proposed to first coat over floors and other surfaces with pigments or paints, combined with gelatine or size, or with paste, and then to apply one or more coatings of drying oils or oils mixed with varnish; but we are not aware of the same having been performed to any extent, or to any considerable advantage. We have thought it desirable thus to call attention to the means of preparing paints or pigments and vehicles, and to the modes of applying the same now known and in use, in order that the peculiar nature of our invention may be readily understood, and distinguishable from previously known means of preparing pigments or paints and vehicles, and of the means of applying them. Now the object of our invention, whether in preparing pigments or paints and vehicles, or in the mode of applying them, relates to means of using soluble vehicles for applying paints or pigments, which vehicles, by an after application of chemical agents or re-agents, are rendered insoluble in water, and will thus allow of paints or pigments so applied and so fixed, to be afterwards washed in order to clean them; and will, at the same time, admit of paints or pigments and vehicles so employed, being applied for the most elegant purposes of house and such like painting, and also to the purposes of the artist, and *for printing paper and other fabrics*; and at the same time in their use they will not emit that disagreeable smell consequent on using oils, or spirits, or varnishes produced therewith, combined with paints or pigments.

In painting, there are few of the colouring matters or pigments used as a single pigment, but they are used as colouring substances to what may be called a body pigment; and, in most instances, white lead (carbonate of lead) is used when oils, or spirits, or varnishes prepared with them, are the vehicles, and the coloured pigments are mixed therewith, in order to

produce the colour or tint of colour desired, and in the quantity desired. Hence in any mode of compounding pigments for the purpose of being applied as paint, it is important to have a good and cheap white pigment, which can be obtained in large quantities; and we prefer for such purposes sulphate of lime, sulphate of barytes, argillaceous earths (or other white pigments may be used, which should be free from iron), and we compound with the white pigment the coloured pigments, in order to produce the colour or the tint of colour desired, in the same manner as heretofore practised. The invention relating to modes of applying certain well-known chemical actions to the purposes of the art of painting, it will now be desirable shortly to explain, and the principles of action which are brought about in carrying out our invention, in order that the rationale of the working of our improvements may be readily understood. It is well known that many chemical agents or re-agents, when brought in contact with gelatine or with albumen in solution, coagulate them, and such coagulated substances, when dry, are insoluble; and such is the case with other matters hereafter described, which, as well as gelatine and albumen, we employ as the soluble vehicles for mixing with pigments, in order to their being used as paints; and, by the subsequent application of chemical agents or re-agents, such vehicles are rendered insoluble, and the paints or pigments employed fixed or set.

Having thus called attention to the general nature of the invention, we will proceed to be more particular in describing the processes of preparing paints or pigments and vehicles, and of their combination, in order to their being in a proper state to be kept prepared, and allow of being transported from place to place. And we will first describe the process of preparing a white pigment in combination with gelatine, adding such preservative means as will keep the gelatine from decomposition, and thus allow of the same, when mixed and ground with pigments, to keep for a very considerable length of time. When using gelatine as the soluble vehicle, we prefer to employ alum as the fixing means, in consequence of its cheapness, and being, as we believe, the best of the chemical agents, which are capable of rendering gelatine insoluble in water, at the same time we do not confine ourselves thereto; and it should be stated, that as most of the paints or pigments will be found to be more or less acted on by the chemical agent or re-agent employed for fixing or rendering the soluble vehicle insoluble, it is important that the pigment employed should be subjected to the action of the chemical agent to be afterwards used in fixing the vehicle or paint. Thus, supposing the pigment intended to be used be an earth, and the chemical agent alum, then we submit the earth to the action of alum, by mixing and washing it in a cold saturated solution of alum, and subsequently, by repeated washings, to remove the undecomposed alum therefrom; and it will then be in a proper state to be ground up with gelatine and water, in the same way as pigments or paints are usually ground. We employ small pug-mills for the purpose of mixing, and, if for immediate use, it must be reduced to the proper consistence with soft water, and will then be laid on to the surface or surfaces in like manner to ordinary paints, each coat being allowed to dry before another is laid on; and when one, two, or more coats have been applied, according to the desire or judgment of the painter or artist, and is become dry, the same is to be fixed by applying a cold saturated solution of alum, or such other chemical agent as may have been determined on; by this means the paint on the surface will be fixed and insoluble in water. Thus surfaces may be painted in the most finished and elegant manner, and it is only necessary to remark, that in using coloured pigments, they should also be first treated with the alum or chemical agent to be employed in fixing the vehicle as above described, in order to prevent any prejudicial action taking place in respect to the colour and to the pigment itself; which in many cases would be the case, should such pigments be used without preparation, and subsequently brought in contact with the chemical agent used to fix the paint. It will be seen, that so far as the simple compounding or mixing pigments with gelatine, when to be immediately used in carrying out our invention, is similar to the ordinary means now resorted to in colouring or distempering; but it will be found that, in order to carry out our invention in the most finished manner, a much larger proportion of gelatine is required; and we shall hereafter give such information as to the relative quantities, as we have found most advantageous; and our invention, so far as relates to the description above given, consists in the mode of treating the pigments employed with the chemical agent, as a preparatory process before mixing the gelatine, and the important process of rendering the gelatine of the mixture or compound, after the

same is laid on to surfaces, insoluble, by means of alum or other chemical agents; and we would remark, that albumen may be used in place of gelatine or in conjunction therewith; and we recommend the use of albumen for the purposes of the artist, where the cost will not be considered an object; yet for general purposes we recommend gelatine, in consequence of the same being much less costly.

(*To be continued.*)

ON ELECTRICITY.

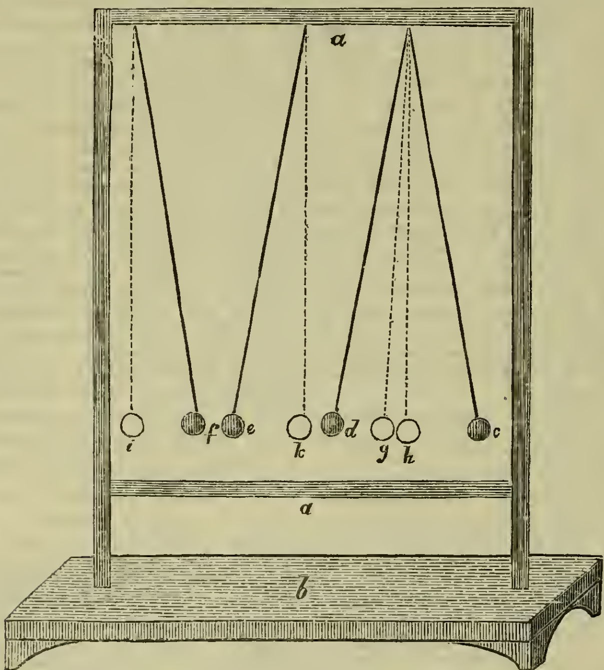
NO. IV.

(*Continued from page* 83.)

THE following is the general law of the phenomena of electrical attraction and repulsion—that bodies, similarly electrified, repel each other, and bodies dissimilarly electrified, attract each other.

a a, fig. 1, is a frame of common deal, about four feet by three, supported upon a proper stand, *b*. From the upper cross bar are suspended, by means of fine silk threads,* four pith balls, *c d e f*. It is necessary that each thread be from two to three feet long; at least if I speak from my own experience, I should say so. I found that threads from nine to twelve

FIG. 1.



inches long, which I formerly used, did not insulate sufficiently; and thus I could never succeed in illustrating this phenomena to my own satisfaction. The balls did not sufficiently diverge, and the electric fluid was speedily dissipated. When I used longer threads, however, I succeeded perfectly, and, on this account, would recommend them to others.

If a rod of glass, excited by silk, be brought into contact with the balls, *g h*, fig. 1, they will first be attracted by it, adhere to the surface for a moment, and will then be repelled. Remove the electric: the balls now having each acquired an electricity, similar to that electric, or, in other words, being similarly electrified, will repel each other, and remain in the

* It has been proved by experiment, that silk of a yellow or golden hue possesses the best, and black the worst insulating properties. This appears to depend upon the nature of the dye employed.

position shown in *d c*. The same thing will happen if, instead of using the glass excited by silk, the sealing-wax excited by flannel is used; the balls in this case also tually repel each other.

But suppose the ball, *c*, when in the position shown at *k*, be electrified with the glass excited by silk, and the ball, *f*, when in the position shown at *i*, be electrified with the wax excited by flannel; they will then be seen to attract each other, as is represented in the figure—proving that they are dissimilarly electrified, or, in other words, that the electricity of the silk is different to that of the wax.

"Hence it follows," says Sir David Brewster, "that excited glass repels a ball electrified by excited glass; excited wax repels a ball electrified by excited wax. Excited glass attracts a ball electrified by excited wax, and excited wax attracts a ball electrified by excited glass." Du Fay, who observed this, was of opinion that it arose from there being two opposite kinds of electricity—the one produced by excited glass, which he termed vitreous electricity, the other by excited wax, which he termed resinous electricity. He believed that these two electricities existed together in all bodies; that they attracted each other, but that they were separated by the excitation of an electric; and that when thus separated, and transferred to non-electrics—as to the pith-balls, for instance—the mutual attraction of the two electricities causes the balls to rush together. But there is another theory to account for this phenomena—a theory far more simple and beautiful, and which is, no doubt, in the same proportion, correct. It is the theory of that great man, Dr. Franklin. He believed that electrical phenomena was not the result of two fluids, as Du Fay supposed, but to one fluid diffused over nature in a state of equilibrium; but that as soon as you disturbed the equilibrium of the fluid in any way—if you took away a portion of it from a body, such body was then in a state of resinous, or, what he termed, negative electricity, and that the body to which it was added, was in a state of vitreous, or, what he termed, positive electricity. He supposed, that when glass is rubbed with silk, a portion of the electric fluid leaves the silk and enters the glass, which then becomes positive, and the silk negative; but that when sealing-wax is rubbed with flannel, the wax loses, and the flannel gains electricity; therefore when we electrify one ball with wax, and the other with glass, we give to the former negative, and to the latter positive electricity; and this is just the reason why they attract each other. They are in opposite or dissimilar states; and bodies dissimilarly electrified attract each other. But some person may say, I suppose then, when one ball, having more than its natural quantity of electricity, comes into contact with one that has less than its natural quantity, the one that has much, has the good nature to give to that which has little, and set themselves on equal terms. A very right supposition. When two bodies, the one in the positive, and the other in the negative state, come in contact, the overplus rushes from the former towards the latter, and the equilibrium is at once restored; and I may as well observe, that this overplus, or what is gained in the positive, is exactly equal, or nearly so, to that which is lost in the negative; therefore it necessarily follows, that when they come in contact, all farther signs of electricity must cease.

(To be continued.)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 84.)

Coventry returns two members to Parliament; the electors are the freemen, about 3000 in number, and the 10*l.* householders, about 1500, which latter were added by the Reform Bill, the sheriffs being the returning officers. Its charter of incorporation was granted by Edward III. in 1344, and afterwards confirmed and extended by James I. There are four annual fairs, the most important of which was granted by Henry III. It commences on the first Friday after Corpus Christi day, and, according to the charter, is permitted to continue the seven following days. The principal manufactures are ribands and watches. Coventry watches, though distinguished for their good appearance and cheapness, were, till recently, considered inferior to those manufactured in London and Liverpool; they are, however, now much improved, and Coventry may boast of nearly rivalling Liverpool, both for the quality of its watches, and the extent of its manufacture. It is a circumstance worthy of remark, that the manufacture of watches is confined to so few places, that there are none of sufficient importance to be recognised in the commercial world, except the following:—Geneva, Chaux de Fond, and Locle, in Neuchatel; London, Liverpool, Coventry, and Paris; and it is only six or seven years since a regularly established manu-

facture was introduced into the latter place, by the formation of a company, chiefly promoted by M. Arago; previous to that time, the watches reputed French, were wholly, or in part, made in Geneva, or Neuchatel. The higher branches of horology, that is, the manufacture of marine and other chronometers, has nowhere attained that height of excellence which has established, and still maintains the superior reputation of London.

WARWICK is a borough, market, and county town, situated nearly in the centre of the county to which it gives its name; It is 90 miles from London, 21 from Birmingham, $10\frac{1}{4}$ from Coventry, and 10 west of the railway. It is pleasantly situated on a rocky acclivity, at the foot of which flows the river Avon. The town, agreeable and commodious in itself, is rendered still more attractive by the magnificent castle, and other beautiful structures with which it is enriched.

The castle, which stands on an eminence on the south-east of the town, is considered the noblest relic of feudal grandeur in the kingdom. Its antiquity is so great as to baffle all the researches of historians and antiquaries; but it is clear that it existed before the Norman conquest, and it is supposed that Ethelfrida, daughter of King Alfred, first erected a fortress here; and an artificial mount on the west side, near the banks of the Avon, is still shown as the place where it formerly stood. The walls of the castle at present enclose an area of three acres. For the following description, we are indebted to an interesting volume, "Mogg's Hand-Book for Railway Travellers."

"The approach to Warwick Castle is calculated to produce the most striking effect. A broad and winding path, cut through the solid rock, confines the eye and exercises the fancy, till a hundred long yards are trodden over with increasing expectation. A method of advance so quiet and serene, prepares the mind for a spectacle of unusual character; and unusually grand is, indeed, the object submitted to view. As we draw towards the extent of this rocky path (by the way rendered smooth), three lofty and massive towers rise progressively to the view; and, on proceeding a few steps farther, they stand ranged in an embattled line unspeakably august and commanding. On the left is the tower termed Cæsar's, an elevation, concerning the date of which no trace remains in published or private record. The mode of construction is somewhat rude, and possesses many singularities. Jutting from one side of this tower is an embattled turret of stone, where imagination may place a herald at arms, demanding in a long past century the name and purpose of those so hardy as to advance unbidden. To the right is the tower, named after the fanciful champion Guy. This part of the structure is upwards of 100 feet in height, and was built by Thomas Beauchamp, Earl of Warwick, in the latter part of the fourteenth century. The entrance is flanked by embattled walls, richly clothed with ivy; and the deep moat, now dry in security, its bottom converted into a velvetty path, is lined with various shrubs, and ornamented with some trees of a vigorous and noble growth. The disused moat is crossed by a stone bridge, and the entrance is by double machiolated towers, through a series of passages once big with multiplied dangers for the intruder. In the great court, to which the visiter passes, the display is truly magnificent. The area is now fertile in soft and well-cultivated green sward; but spread around are viewed the mighty remains of fortifications, raised in turbulent ages by mingled ferocity and grandeur. The relics are perfect in outline, and no battlement exhibits the havoc of time, while the hand of tasteful domestic habit has spread a softness over the whole, productive of most grateful relief. We behold with pleasure the ivy bestow pictorial mellowness on parapets and turrets, which must have been only terrifically rugged when manned with warriors in steel, and fresh in early masonry; and broad Gothic windows supplant, with conspicuous felicity, the cheerless single-light, and fatal loophole.

The habitable part of this immense structure lies to the left of the great court; and in the progressive amelioration of feature effected in later ages, every desirable attention has been paid to consistency of character. At the western, or more retired part of the area, is the artificial mount, a vast elevation, surmounted by a portion of ancient building. The walls which range round those divisions of the court not occupied by the residence, are guarded by ramparts; and open flights of stone steps lead to various turrets, and form, with many passages, a ready line of communication through the whole of the fortress. A grand face of the building is displayed towards the river; and here the rock, which affords a foundation to the pile, rises perpendicularly to a considerable height before the stone-work of the superstructure commences. This front has all the irregularity usual in buildings

constructed with a view to security, as well as baronial grandeur; but even this want of uniformity is estimable when considered as a characteristic of antiquity. The windows have experienced some alteration under the direction of the present earl, and much good taste has been evinced in every particular.

The interior of this august fabric surpasses the expectations raised by a view of its outward features; for with the ponderous towers and ramparts of stone, we associate only ideas of chivalric hardihood and unpolished baronial pride. But domestic elegance, and a warm love of the arts, have combined in recent periods to arrange and decorate the halls; yet every effort at fresh and more gratifying modes of disposal, has been carefully made allusive to the antique, castellated outlines of the edifice. The grand suite of apartments extend in a right line 333 feet, and are furnished in a chaste but munificent manner."

(*To be continued.*)

LONDON AND BLACKWALL RAILWAY.

THE trains are propelled to Blackwall by means of two stationary engines, of 120-horse power each, which are worked in shafts sunk into the earth to the right and left of the lines. To these engines, fly-wheels, or, as they are technically termed, "drums," are attached, each of which is of the ponderous weight of forty-four tons, and is twenty-two feet in diameter. A tail-rope is fastened to the drums, which is wound and unwound at each end by the stationary engines, there being also two engines of seventy-horse power each, sunk beneath the Blackwall terminus. As the train proceeds to the latter place, the drums at the London terminus unwind the rope by which the carriages are to be again drawn to London; and to prevent the rope flying across the sheaves in which it runs, too rapidly, and thus becoming entangled in consequence of no weight being attached to it, an ingeniously-contrived break is placed on the platform by the side of the railway, at which a man is employed to regulate the unwinding of the rope. The rope is not an endless one, similar to that employed at the Euston Square station of the Birmingham Railway, but it is in two parts—namely, one for propelling carriages to Blackwall, and the other from that place. It was manufactured by Sir Joseph Huddart and Co., of Limehouse, and cost upwards of 1200*l.* The "drums" take eighty turns to every mile of the ropes, each of which are three miles and a half in length.

The electric telegraph is the next object of attraction, and it is enclosed in a neat mahogany case, that is, so far as it is seen above the ground, and a small bell announces when the train is about to be put into motion. The telegraph is the invention of Messrs. Cook and Wheatstone, and enables parties at each end of the railway to hold conversation with each other with the most perfect facility. At each of the intermediate stations one of the telegraphs is placed, to enable the servants of the railway to communicate with the engineers at the termini; and it was stated, that notice of any impediment or casualty might be given at an intermediate station to one of the termini, and thence conveyed to the other end of the line in the short space of three seconds.

The line proceeds on a series of arches from the Minories to the West India Docks, across the Regent's Canal and the river Lee. The span of the arches crossing the canal and river is from thirty to forty feet, and from the West India Docks the line runs upon an embankment, and the ground falls into a very rapid decline of 1 to 150. So that from the Marsh to the Blackwall terminus, the embankment is but a few inches in height. The difference in the level of the line, from one end to the other, is eighteen feet. The three intermediate stations – namely, the Stepney, the Limehouse, and the Marsh, are exceedingly neat externally, and conveniently fitted up internally for passengers who have to wait for the trains.

The railway is fenced in with a light and ornamental iron palisade, which is materially better than the walls of the Greenwich; as it prevents a reverberation of sound, and, consequently, on the Blackwall Railway, the passengers are not subject to annoyance from a continued and deafening noise. The iron-work also presents a more pleasing view to the eye. The length of the railway at present is three miles and a quarter, and when it is carried on to Fenchurch Street, it will be three miles and a half. The railway was projected in 1828, and the bill passed for its formation from Blackwall to the Minories in 1837. Another Act of Parliament, authorising the Company to extend their works to Fenchurch Street, was obtained in 1839. The estimate of the whole was 600,000*l.*, of which 450,000*l.*, or thereabouts, has been expended. The stationary engines, it was said, cost about 30,000*l.*

The first class carriages are of the usual

description, except that there are no elbows to the seats. The fare to either of the stations will be 6*d.* by the first class, and 3*d.* by the second class. The second class carriages are of the same construction as those on the Manchester and Leeds Railroad, and are termed by engineers "stand-ups," there being no seats to them, and the passengers having to stand during the journey. The weight of the railway carriages is estimated at five tons each, exclusive of passengers.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 22, Rev. R. Vaughan, on Ancient Persia. Friday, July 24, F. M. Innes, Esq., on the Present State and Future Prospects of the Australian Penal Colonies. At half-past eight precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 22, Mr. H. Wiglesworth, Lecture and Discussion, "Should Circumstantial Evidence be sufficient Grounds for a Jury to convict a Prisoner." At eight o'clock.

QUERIES.

Can new hemp fish-lines (such as are used for catching pike) be prevented from twisting when first used, as new lines invariably twist all up to one knot; and it is not until they have been used several times with much trouble, that they will keep straight in the water? Is there any process to prevent this? M. Turnor.

How to convert India-rubber into a cement? Inquirer.

ANSWERS TO QUERIES.

To Prepare Sulphuretted Hydrogen.—Pour dilute muriatic or sulphuric acid over black sulphuret of iron or antimony in a retort: for nice experiments, it must be collected over mercury.

Pyroligneous Acid is obtained by the distillation of wood. Its specific gravity is 1.009. It contains about one-twentieth of its weight of absolute acetic acid. Manipulator.

To Scent Windsor Soap.—The perfume used to scent Windsor soap is oil of cloves.

Waterproof Liquor for Soles of Shoes.—Roche alum, four ounces; sugar of lead, two drachms; powdered gum-arabic, one drachm; water, eight ounces.

Another.—Indian rubber, one drachm; oil of turpentine, six ounces; linseed oil, eight ounces.

TO CORRESPONDENTS.

H. O. P. E.—*The true proportion between the diameter and circumference of a circle is not known: it cannot be discovered by any process at present known. See page 296, Vol. IV., where it is given true to the hundred and fifty-fourth place of decimals. Most of his other queries have been answered in recent articles. We are often asked, "which is the best book" on some particular subject, and "where is it sold, and its price?" The publication of such information would subject us to the advertisement duty. We are now asked, which are the best works on algebra, logarithms, and astronomy?—It depends entirely upon the progress the learner has already made. If he has all to learn, he should take Fenning, or any other book that explains those parts of numerical arithmetic which apply to algebraical fractions, &c. It is in vain to attempt to pounce upon astronomy, without the preparatory study of geometry, algebra, &c.; the best books would be unintelligible, and those that are intelligible to the uninitiated, are useless. We know of no better books on these subjects, than those used at Cambridge. Vince's "Elements of Astronomy" will take the student quite far enough for most purposes.*

J. M. D.—*The brass rings which conjurors appear to link and unlink, have no joints; they are provided with a certain number linked together, and others which are detached. The deception is in substituting one set for the other. The reason of a pendulum being unfit to regulate the motion of an equatorial is, that a continuous and even motion is required, and the pendulum with an escapement, as in a clock, admits only of an intermitting motion, the whole machinery being at rest, or retrograding, according to the construction of the escapement, during a period of every vibration. His suggestions will be attended to.*

An Amateur Chemist.—*The petrifying property of certain springs has been mistaken and misrepresented by some writers. The substances exposed to their action are not converted into stone, but only covered with a stony deposit. (See* Mechanic, *Vol. IV., page* 381.*) In the fossil remains of animal and vegetable organic bodies, decomposition has evidently taken place, and recombination with extraneous matter has succeeded; and this is so evident, that the different parts of a fossil body retain, to a certain extent, the characteristics of their original composition, as may be seen in fossil shells, compared with the animal contained within. The process is of many ages' duration; but its precise nature and rationale, have hitherto eluded the researches and investigations of the chemist. The occurrence of flints in chalk, &c., and, which is still more remarkable, masses of primitive rock on the summits of the highest mountains, has not yet been explained by any rational system of philosophy.*

Errata.—Page 83, line 22, for "electrics" read *non-electrics*; and for "non-electrics" read *electrics*. Line 59, for "shock" read *spark*.

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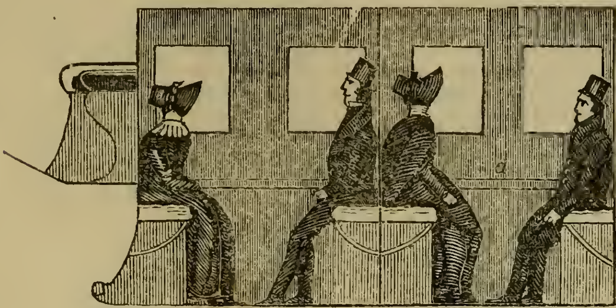
// MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 102, NEW SERIES. | SATURDAY, JULY 25, 1840. PRICE ONE PENNY. | No. 223, OLD SERIES.

PATENT OMNIBUS.

Fig. 1.



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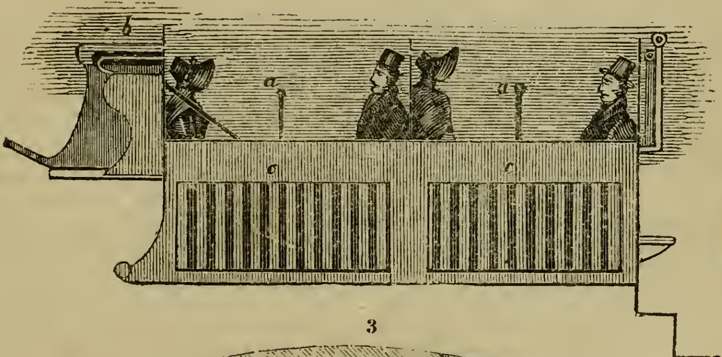

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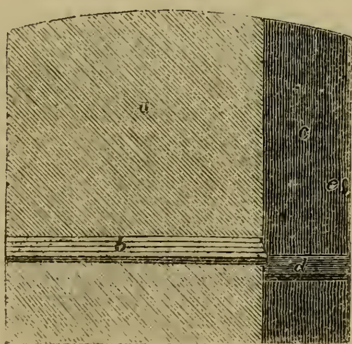


City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

A FEW REMARKS ON THE PATENT OMNIBUS.

(See Engraving, front page.)

Description of Engravings.

Fig. 1 is a transverse side view; *a a* is a hand-rail passed along the opposite side.

Fig. 2 is a side view of its summer appearance; *a a* are speaking-trumpets; *b* is the coach-box; *c c* are the ventilators.

Fig. 3 is a transverse back view; *a* is the partition; *b* the seat fixed this side of it; *c* is the front of the omnibus. The door behind is of the same size as that part which is seen front in this view; *d* is the seat in the front.

Since, in No. 40 of your last volume, you called the attention of your numerous readers to the construction of the patent omnibus now brought into use on public roads, I take this opportunity of making a few remarks on the alterations described, and then proposing a plan which I consider better calculated to enhance the comfort of those vehicles.

The inventer of the patent says, "One of the chief objections to the common omnibus, is the great inconvenience experienced in passing to and from the seats;" and the danger "of being jolted against the nearest parties, and perhaps thrown down before reaching the seat." This I think somewhat exaggerated, for we seldom find any serious annoyance from this source; and the fall of a person is a thing I never saw, or, indeed, heard of. As, however, it is not always possible to keep the conveyance steady, while parties are getting in and out, the hand-rail, where applicable, is a decided improvement. The next objection he has, I think, greatly magnified; for he states, "that from the risk people run of catching cold, the windows are seldom opened." During the summer months, you rarely enter an omnibus in which some are not down. It, however, cannot be denied, that if the situation of ventilation could be satisfactorily altered, it would be no mean improvement. How far the patent omnibus effects that object, I will not undertake to say. The third objection he mentions, is the impunity with which robberies are effected, and which, he says, is, in a great measure, attributable to the "confusion" occurring when parties are entering or leaving, "and from the general exclusion of light." Now on this ground, at least, I think he has no reason to boast; for the position a seated person must put himself in, when another is getting in or out of the carriage—viz. coiling up his legs under the seat, and slightly turning on one side, will afford an opportunity to that class of gentry, termed pickpockets, for the performance of their silent operations, scarcely ever before offered them; and as there are no persons opposite to observe them, they will certainly not only effect their purpose with greater facility, but also security. The inventer then states, that "many other improvements are made, among which is the indication of the side of the road a gentleman wishes to be set down, by means of bells." The possibility (when accustomed to the bells) of the conductor's forgetting any directions he may have received of a gentleman getting in, and, in consequence, conveying him farther than desired, or the probability of two bells sounding at the same time at a cross street, owing to which, either one person must be put down wrong, or both, to their mortification, set down in the middle of the road—are, I think, sufficient objections to this alteration. The slight advantage of the hand-rail, then, the altered situation of the passengers with regard to the windows, and the communication with the conductor by means of bells, are the only things to weigh against the increased weight and width of the omnibus, the greater facility offered to thieves, the inconvenience of getting in and out, and uncomfortable position of the legs when in; together with the division which must take place, of a lady and gentleman or little party, when there is not room for the whole in one compartment, and the annihilation of that convenience to social conversation felt when parties are opposite one another. I think, when these things are calmly considered, the patent omnibus will be thought a decided failure. I will now briefly describe the plan I have thought of. I propose, then, that the vehicle be of sufficient breadth to admit four persons abreast at the front end, opposite to which a seat for three is to be placed, leaving room for one to pass; the back of this seat is to reach to the roof; on the other side of this partition is to be another seat for three; opposite that again, against the back, must be another seat for the same number. On the outside must be a seat for three, beside the coachman. It should be also so constructed, that (when desired) the roof, half of the sides, and part of partition and back, may be easily removed; thus, in hot weather, rendering it more comfortable for passengers, and lighter draught for horses. For the farther ventilation of the conveyance, a row of thin narrow bars, the spaces between each being of the same width as the bars

themselves, should be fixed all round; behind which should be another row of the same size, moveable for a little way backwards and forwards by the passengers, in the same manner as some of Dr. Arnott's stoves are regulated, the inside bars filling up the spaces of the outside row when required. In winter, to prevent the cold, in addition to the bars being closed, a board might be fastened up against them, with buttons. I think the lowering of the coach-box, and the communication with the conductor being made through speaking-trumpets carried along the sides up the back, would be also improvements. I have also thought of a plan, by which the distracting noise occasioned by the rattling of the windows, which so haunts the omnibuses at present in use, might be prevented; and also a way by which the roof, &c. may be easily removable, in the manner I have described; but these I will not mention now.

I remain yours, &c.

AN ADMIRER.

ON ELECTRICITY.

NO. IV.

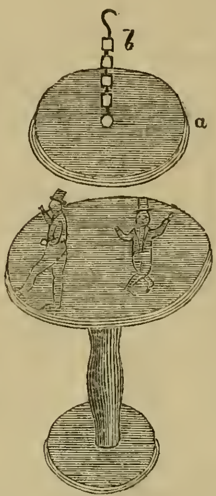
(*Continued from page* 93.)

THERE are some curious and interesting experiments, which illustrate the phenomena of electrical attraction and repulsion. I will name two or three:—Take a glass tumbler, and electrify it on the inside, by placing it over a pointed wire, projecting from the prime conductor of the machine. When sufficiently charged, place it over about a dozen pith balls, and they will immediately be thrown into violent motion; they will be first attracted by the charged glasses, when, having acquired an electricity similar to that glass, they will be repelled by it. When they arrive at the table, this electricity is carried away, and they are again susceptible of attraction and repulsion. After a short time, however, as the fluid dissipates, the motion will gradually subside, and at last cease altogether.

Here is another experiment on exactly the same principle, only in a different form.

a a, fig. 1, are two round metallic plates; the upper one, when about to be used, is suspended by means of the chain, *b*, to the prime conductor of the machine; the lower one is supported on a proper stand, and communicates with the ground. Between these two plates (which are from six to twelve inches apart, according to their size, and the power of the machine) place two or three figures, cut out of cork or the pith of elder, and as soon as the machine is turned, they will assume an ani-

FIG. 1.

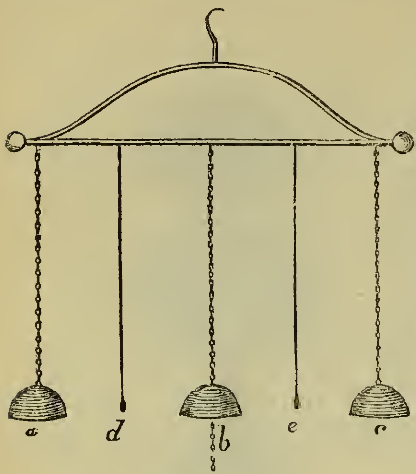


mated appearance, being first attracted and then repelled. This experiment is the more interesting, as there is no apparent cause influencing their movements; but they appear to dance as if by magic. Had such a thing been known at an earlier day, the experimenter would, doubtless, have been burnt at a stake, or boiled in a cauldron for witchcraft. What an influence has education had in purging us from such superstitious enormities!

The electrical bells furnish another pleasing illustration of the attractive and repulsive properties of the electric matter. The two outer bells, *a c*, fig. 2, are suspended by metallic chains. The two clappers, *d e*, and the inner bell, *b*, by silk threads. The bells being attached to the machine when in action, the electricity passes along the chains, being conductors to the outer bells; but will not pass along the silk, being an insulator to the clappers or inner bell. The outer bells being thus charged with electricity, attract the clappers; but as soon as they come in contact, they are repelled with sufficient force to cause them to strike against the inner bell, upon which they deposit their electricity, and are again attracted. By this means a constant ringing is kept up, while the machine is turned. From the inside of the middle bell, a chain passes to the ground, for the purpose of carrying off

the extra quantity of electricity deposited upon it by the clappers.

Fig. 2.



If the figure of a human head, covered with hair, be placed upon the prime conductor of the machine and electrified, the hair will stand on end, each filament appearing as if it avoided the other, and will present a frightful appearance. This arises from their being similarly electrified, and, therefore, each repels the other.

In the formation of electrical apparatus, great care should be taken that every instrument be as smooth and round as possible; for it is a curious fact, that the power of retaining electricity in a body, is very much influenced by its shape. A sphere and a cylinder, with a hemisphere at each end, as the prime conductor of the machine, for instance, are the best forms for its retention. But this fluid escapes in a surprising degree from every pointed body. From the ball of the prime conductor, when the machine is in action, a strong spark can be obtained ; but a great difference will be observed, if one or two finely-pointed wires be placed in the holes of the conductor ; we can then elicit very feeble symptoms of electrical action, the fluid being carried away by means of the point. And it not only possesses the power of dissipating or carrying away the electric fluid, but likewise of collecting it; and this is the reason why we attach a row of points to the conductor of the machine on the side nearest the cylinder, as electricity is collected more speedily in bodies of this shape than in any other. If I were to place my hand over this point when the machine is in action, I should feel a current of air rushing against it, which depends upon the mutual repulsion of the different particles of the air, causing each rapidly to recede. It is termed the aura electrica, and is sometimes used for medical purposes. In the dark, it has the appearance of a brush or pencil of light. If a candle be placed in the vicinity of this current of air, it will act upon it, in the same way as when it is put in motion from any other cause. The following is a representation.

Fig. 3.

Seeing, then, what an effect every point has in carrying away the electric fluid, every one will easily perceive how absolutely necessary it is, as I before hinted, to have all electrical apparatus as free from asperities, or nearly round, and in as polished a state as possible. Is there any young experimentalist who reads these lines, that would like to try his skill in making his own apparatus? listen to the remark which I have just made ; and let me tell you, my young friend, that if you wish to succeed, you must avoid, as you would a serpent, all sharp edges and corners.

SPILBURY'S PATENT IMPROVEMENTS IN PAINTS AND VEHICLES, &c.

(Abstract of Specification.)

(Continued from p. 92.)

We will now describe such mixtures or compounds as we have found to answer, and believe will be found to be the best.

Preparation of Paint or Pigment when desired to be kept.

White Paint.—Take 160 pounds of sulphate of lime, or sulphate of barytes, or white earth, well washed, in order to separate all foreign matters, as is well understood, and which has been treated with the chemical agent, as above explained ; mix therewith about twenty pounds of solid gelatine, and about fourteen pounds of sulphate of zinc (or other

suitable material to preserve the gelatine from decomposition, may be used), dissolved in 160 pounds of warm water. The state in which we prepare this compound, is that of very thick paste, which we pack in small casks, or the compound may be dried with or without sulphate of zinc or other preservative; or the dry pigment may be prepared or mixed with dry gelatine or dry albumen; but we prefer the semi-fluid or very thick pasty state, which is a very convenient one for transport. It should, however, be remarked, that if albumen be employed, sulphate of zinc is not to be used. We would remark, that we do not claim the application of sulphate of zinc, or any other of the known modes of preserving animal matter from decomposition generally, the same not being new in itself; and we only employ such mode or modes when compounding pigments with gelatine, or when preparing gelatine for the purpose of being used in compounding paints and pigments, in order to preserve the gelatine, that the prepared pigments and vehicles may be transported from place to place, and keep good for a considerable length of time. The use of sulphate of zinc, otherwise improves the quality and increases the durability of the paint when applied. It should be stated, that the means of preserving gelatine heretofore most generally practised, in order to its keeping for some time, by sulphurous acid, acetic acid, and alum, are not proper for the purposes of our invention, and, therefore, are not to be used; but in employing preservatives with gelatine, it must be done in reference to the fixing process, or after application to surfaces as herein described; and we use, by preference, sulphate of zinc, or other soluble salts of zinc, the soluble salts of magnesia, and the soluble salts of lead. In case the pigment is to be tinted or coloured, then the white pigment employed is to have coloured pigments combined, or intimately mixed therewith, in order to produce the tint of colour desired, *unless the coloured pigments by themselves are to be employed*, which is seldom the case in colouring or painting; and such coloured pigments are to be first treated with a cold saturated solution of alum, or other material, to be afterwards employed in fixing the soluble vehicle, by rendering it insoluble. It may be desirable to remark, that we have found that some specimens of pigments have not required any previous preparation, while others from the same place have been prejudicially acted on, when used without previous preparation or treatment, by the chemical agent to be afterwards used; under these circumstances we have found it desirable, as the trouble and cost is but small, to prepare all the pigments we employ, by first subjecting them to the action of alum, or other material to be used afterwards in fixing, by rendering the vehicle employed insoluble. And we would remark, that the mere rendering gelatine and albumen insoluble by alum or other known chemical means, forms no part of our invention; and as the chemical agents which so act, are known to chemists, and as we, in carrying out our invention, have, as before described, used alum when gelatine or albumen is used for the vehicle, and believe it to be the best for the purpose; we have not thought it necessary to enter more at large into the chemical matters, which are capable of rendering gelatine and albumen insoluble; yet as other persons may consider it desirable to employ other chemical agents, we recommend, that whatever be the agent employed, the pigment and vehicle should be tested by it, by applying a small quantity of them to a surface, in order to ascertain whether it will retain its property of fixing, and not have any prejudicial action in respect to the pigment or vehicle, when combined, or to the colour thereof.

Another part of our invention relates to a like mode of employing other soluble vehicles for pigments, in which the vehicles are to be afterwards rendered insoluble by alum, or other known chemical re-agents; and this part of the invention relates to the employment of resinous matters dissolved in a solution of borax, or in an alkaline ley; and this part of the invention also relates to the employment of wax dissolved in an alkaline ley.

As an example of the former, we take well-bleached shell-lac, and combine it with borax, in the proportion of about five pounds of the former to one pound of the latter. These are boiled until dissolved, in about four gallons of water; with this vehicle, the pigments required are to be ground to the proper consistency of paint, which is to be laid on in the usual way, one or more coats, as required; and, when dry, it is to be washed over with a solution of alum, or other chemical agent, which is known to destroy the combination of the lac and the borax, rendering the lac insoluble.

(*To be continued.*)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 95.)

"THE HALL is a noble room, sixty-two feet long, and thirty seven feet wide, paved with black and white stone, and wainscotted. Various weapons and pieces of armour, interspersed with antlers, are attached to the sides. Piled round the wide fire-place are logs of wood, in attention to the usage of the ancient barons' household, in which establishment convenience was ever studied in preference to delicacy. But the hall is, properly, the only apartment devoted to so strict a *keeping* of manners. The sides of the *antechamber* are panelled, and edged with gilt moulding; the floor is of polished oak.

The Cedar Drawing-room is of large proportions; the floor is of polished oak, the sides, lined with cedar, are well carved; the ceiling is highly ornamented, and the furniture superb. The *Gilt Room* is richly embellished. The *State Bedchamber* is hung with curious tapestry, worked at Brussels in 1604. The costly bed-furniture belonged to Queen Anne, and was given to the late Earl of Warwick by King George III.

The *Dining and Breakfast-rooms* are also charming apartments. A valuable collection of family portraits, and other pictures of distinguished merit, are judiciously distributed throughout the different rooms, the gallery leading to the chapel, and principal passages.

The *Gallery of Armour* contains a fine collection of old English mail. The *Chapel*, approached by a gallery, though not large, is of a sedate and decorous character. The windows of each room in the grand suite command diversified and lovely prospects. To the right, the river Avon winds through a long expanse of decorated park scenery. On the left, various objects intercept the view, but all are consonant and picturesque.

The *Park* attached to this noble castle, is very extensive, and finely adorned by wood and water. The garden grounds, or home domain, are arranged with the exquisite order of taste that has its basis in simplicity. A broad gravel walk, of devious progress, conducts through these grounds, and is embowered by a rich variety of evergreen foliage. Different vistas, designed with great judgment, afford fine views of the castle, the windings of the Avon, and principal features of the surrounding country. In a conservatory, erected for the purpose, is deposited a very large *antique vase*, presented to the Earl of Warwick by the late Sir William Hamilton. This magnificent antique is composed of white marble, and is of a circular form. The decorations consist of Bacchanalian emblems, finely executed; and from the body of the vase proceed two handles, formed of interwoven vine-branches. This vessel is calculated to contain 163 gallons.

The lofty artificial mount on the west of the castle, is now ascended by a spiral path, skirted by protecting trees and shrubs. At an advanced point of the ascent is a turret, approached by stone steps; but on the summit of the elevation, supposed to have been formerly crowned with the gloomy residence of the lady of the Mercians, a large fir waves its broad branches in pensive but grateful triumph.

In one of the rooms attached to Cæsar's Tower, are still preserved the sword, shield, helmet, &c., ascribed to the legendary champion, Guy. The reader will scarcely need to be informed, that this personage is reported to have been an Earl of Warwick, who fought with and slew a gigantic Dane, by name Colebrand. After this duel, he is said to have retired to a hermitage, on the secluded and romantic spot since named "Guy's Cliff," where he died and was buried.

During the civil war of the seventeenth century, the town of Warwick suffered severely from the active part taken by Lord Brooke in public affairs. The castle was now rendered a depository of arms, and placed in a regular state of garrison. This stronghold at one period of the war sustained a siege, and several skirmishes occurred in the neighbourhood. Nor were the more ancient seasons of freedom from personal danger productive of entire tranquillity to the inhabitants; for when relieved from the appearance of professed foes, they were continually harassed by the visits of armed throngs, who were only preferable to the enemy because they drained the householder's purse and board without holding a sword to his breast.

In the year 1694, Warwick experienced the calamity of a dreadful fire; when the greater part of the town, including the High Street, and nearly the whole of St. Mary's Church was consumed. The loss sustained on this occasion has been variously estimated: it was computed at the time to amount to 96,000*l.*; but it is said that 120,000*l.* were employed in repairing the damage. The sum of 11,000*l.* was collected by brief, to which Queen Anne munificently added 1000*l.* as a royal gift. This affliction, like all others of a similar

nature, though bitterly severe to the inhabitants of the period, was productive of great local improvement; and we may safely assert, from the aspect of those parts of the town which escaped the conflagration, that the place is entirely indebted to its temporary misfortune for its chief domestic ornament. But although the buildings were improved in size and character, when the town was thus restored, the principal streets were originally disposed with considerable regularity.

The principal church is dedicated to St. Mary. Although this building has no pretensions to beauty, it is still firm and capacious. At the west end is a square tower, the height of which, from the base to the top of the battlements, is 130 feet. Between the piers supporting the tower, a passage is wrought, allowing the transit of carriages. The church is of a cruciform description. The extreme length is about 186 feet; the breadth, 66 feet. The cross aisle measures 100 feet 6 inches. The interior is rendered august by the remains of the ancient structure. We here view the choir, untouched by the ravage of the flames, and stand with reverence amid the memorials of a family, conspicuous in national history. On each side are ranges of stalls. The stone ceiling is finely designed and delicately worked. Among the chaste, yet ample and elegant embellishments, are introduced the arms of the founder, and his arms quartered with those of his wife embosomed by seraphims. In the middle of the choir is the altar tomb of Thomas Beauchamp, Earl of Warwick, and his lady, Catherine, the daughter of Roger Mortimer, first Earl of March. On the tomb are the recumbent effigies of the persons interred. The earl's figure is in armour, and his right hand clasps the right hand of his countess, whose left is on her breast. On the sides and ends of the tomb are thirty-six figures, representing the closest relatives of the deceased earl, with coats of arms beneath. These figures, usually termed *weepers*, curiously exhibit the peculiarities of dress prevailing at that period."

RICHARDSON'S SAW.

To the Editor of the Mechanic and Chemist.

Sir,—In your notice to correspondents, I find in No. 99 an application to know my address by a Mr. Barry. I should feel happy to give him the information he requests, but would rather defer it for about two months, when I shall be able to state what the machine will do by actual practice on a larger scale, being now engaged in fitting it up for work. I am also trying an experiment to drive the same, together with a lathe and a circular saw, by a set of wind-sails, without any toothed gear at all. I do not think I can possibly get it at work before the end of September.

Charles Richardson,
Builder.

Godalming, Surrey.

MISCELLANEA.

To Manufacture Small Models of Balloons.—Now that the season of the year has arrived, when possibly some of your juvenile subscribers will amuse themselves by manufacturing small models of balloons for experiment or amusement, I extract for their information from the *Encyclopædia Britannica and Londinensis*, a few particulars which, perhaps, may be serviceable to them:—

"White smoke, produced from burnt straw and small wood, is one-third lighter than the common air.

It is the union of heat and moisture that gives to air its greatest expansion.

One cubic foot of air weighs 554 grains, and expands one-five-hundredth part of its bulk for every degree of heat added to it.

Five hundred cubic feet of air obtain an ascensive power of one ounce for every degree of heat added.

A balloon of ten feet diameter will raise twelve pounds, independent of any weight. One of 50 feet will raise 1562 pounds, and one of 100 feet, 12,500 pounds.

Measure for Balloons and other Spherical Bodies.—The diameter of a circle is to its circumference as 7 to 22.

To ascertain the superficial measure or extent of surface, multiply the diameter by the circumference.

To find the capacity or the number of feet of gas or air it will contain, multiply one-sixth of the surface by the entire diameter, or take $\frac{11}{21}$ of the cube of the diameter.

An excellent Varnish for Tissue Paper to be used for gas balloons, is made by adding two parts of drying linseed oil to one of the solution of India-rubber, and mixing them by means of heat. To be applied warm, and on both sides of the paper."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 29, Rev. R. Vaughan, on Ancient Persia. Friday, July 31, F. M. Innes, Esq., on the Present State and Future Prospects of the Australian Penal Colonies. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, July 30, B. R. Haydon, Esq., on the Principles of the Human Form. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 29, a Lecture on Phrenology. At eight o'clock.

QUERIES.

The simplest method of constructing a small force-pump for a fountain? A. S.

What are the ingredients used for making the compo-ornaments for picture-frames, or something that, when taken from the mould, will allow of being bent in any required direction? What I want them for is the interior decorations of the ceiling of our church, being myself the contractor for that work. C. RICHARDSON.

ANSWERS TO QUERIES.

Oil of Ben is extracted from the ben nut by gentle pressure; it will not grow rancid by keeping. Its specific gravity is 0.917.

Oil Paper for Paste Blacking may be made by brushing over paper with drying linseed oil, and allowing it to dry.

Lactucarium or *Lactucine* is extracted from the lettuce, and is narcotic in its medicinal properties.

Blacking Recipes.—Lamp black, six pounds; sugar, six pounds, dissolved in two pints of water; sperm oil, one pound; gum-arabic, three ounces, dissolved in two pounds of vinegar; vinegar, three gallons. Mix; then add gradually one pound and a half of sulphuric acid.

Or, ivory-black, three-quarters of a pound; treacle, three-quarters of a pound; sperm oil and sulphuric acid, of each three ounces; vinegar four pints. Mix.

Or, ivory-black and treacle, of each two pounds; neat's foot oil, eight ounces; sulphuric acid, one ounce; gum tragacanth, two ounces; vinegar, six pints. Mix.

Or, ivory-black, six pounds; vinegar and water, of each two gallons; treacle, eight pounds; sulphuric acid, one pound. Mix.

Or, ivory-black, one ounce; small beer or water, one pound; brown sugar and gum-arabic, of each half-an-ounce; and, if required to be very shining, the white of an egg. Mix.

Polishing Powders.—Mercury with chalk (the hydrargyrum cum creta of the chemists), one ounce; fine whiting, four ounces.

Another.—Putty powder (an oxide of tin) and burnt hartshorn, of each eight ounces; fine whiting, one pound.

Fumigating Pastiles.—Benzoin. two drachms; cascarilla bark, one drachm; myrrh, half-a-drachm; oil of nutmeg and oil of cloves, of each fifteen drops; nitre, one drachm; charcoal powder, one ounce and a half; mucilage of gum-arabic, a sufficient quantity.

To make Lemonade.—Mix one part of citric acid with six of powdered loaf sugar. A very fine dry lemonade is thus prepared, which will keep for any length of time The quantity to be used for a glass of water, must be regulated by the taste of the person using it. If it should be required to effervesce, add a half part of carbonate of potass.

To make Crimson Fire.—Dry nitrate of strontia, forty parts; flour of sulphur, thirteen parts; chlorate of potash, five parts; sulphuret of antimony, four parts, and a little powdered charcoal. The ingredients should be separately powdered, and then mixed, adding the chlorate the last.

Bengal Lights are composed of six parts of saltpetre, two of sulphur, and one of sulphuret of antimony; or seven of saltpetre, two of sulphur, and one of sulphuret of antimony; or, eight of saltpetre, four of sulphur, and one of sulphuret of antimony.

Green Fire.—Dry nitrate of baryta, seventy-seven parts; sulphur, thirteen parts; chlorate of potash, five parts; charcoal, three parts; metallic arsenic (powdered), two parts.

Yellow Fire.—Nitrate of soda and chlorate of potash, of each two parts; sulphur and charcoal, one part.

To make a Jet of Red Fire.—Take fifteen parts of mealed powder, and four parts of dry nitrate of strontia.

Jets of other Colours may be produced by substituting the proper "colouring salt" for the nitrate of strontia, as nitrate of baryta for green, and nitrate of soda for yellow.

For a Jet of Blue Fire, use mealed powder, four parts; nitre, two parts; sulphur, three parts, fine zinc filings, three parts.

TO CORRESPONDENTS.

F.—*Photogenic drawings upon paper may be made to show the lights and shades in their proper places, by producing a picture on thin transparent paper, and applying that picture to another prepared paper, and exposing them to the action of the sun. See No.* 16, *N. S., of "Mechanic."—The "Air Light" is noticed in Nos.* 105, 108, 111, *and* 118, *O. S., of the "Mechanic." It is a contrivance to burn the* vapour *of a combustible fluid; it produces a brilliant light, but is attended with much inconvenience, and has not succeeded. If any convenient process could be discovered to separate the oxygen from the azote in atmospheric air, or from hydrogen in water, the great problem of producing good and cheap light would soon be solved.*

R. L. *will receive a letter by post.*

A Subscriber *has our thanks for pointing out an error which appeared in a recent No. It was stated, that objects viewed through the Stanhope lens, should be placed on the* least convex *side of the glass; it should have been the* most convex *side.*

A letter directed to Mr. W. H. Hewitt, *still remains at our Office.*

Several correspondents not noticed in the present Number, will be attended to next week, or as soon after as possible.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

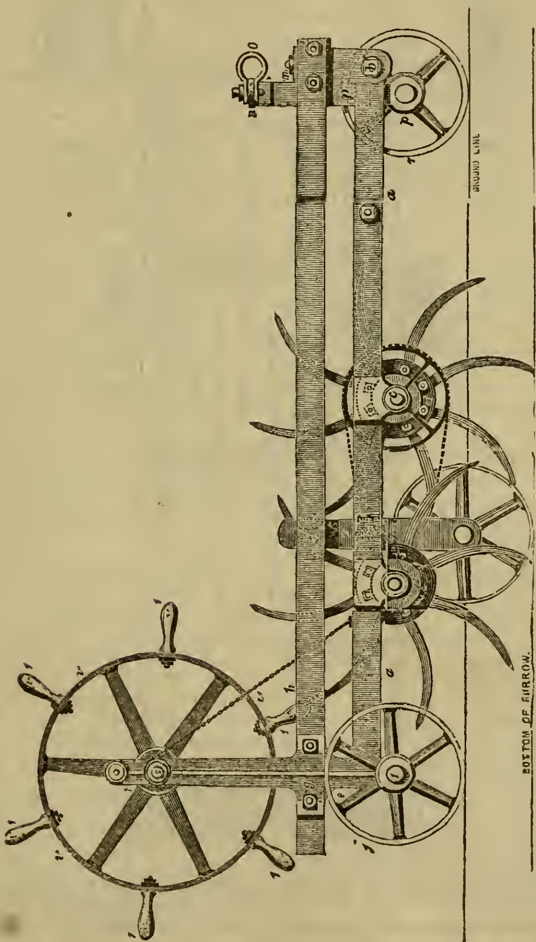
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 103, NEW SERIES. | SATURDAY, AUG. 1, 1840. PRICE ONE PENNY. | No. 224, OLD SERIES.

VAUX'S PATENT REVOLVING HARROW.



The Letters in the Engravings are intended to elucidate the specification of the Patent. A Copy of the Specification will accompany the License.

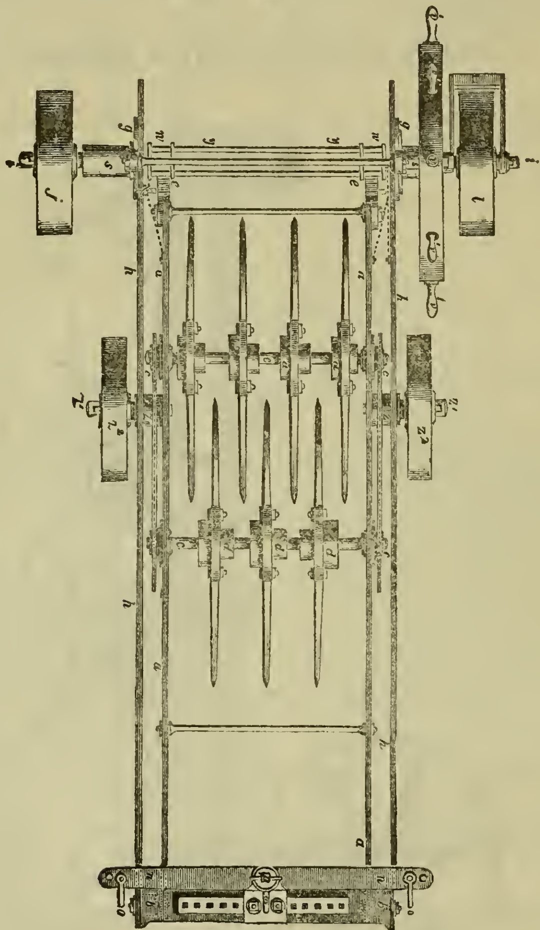
 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

VAUX'S REVOLVING HARROW.

To the Editor of the Mechanic and Chemist.

Sir,—Feeling assured that you are anxious, not only to furnish the most useful information in your power, but to do it as correctly as circumstances will admit, I consider it a duty I owe to you and to myself, to supply the means of correcting some *errors* which your correspondent has fallen into in the drawing of my "Revolving *Harrow*," as well as to correct the letter-press accompanying it. With this view, I beg to forward a drawing of it, and prospectus; and to state that, should you consider it worthy of farther notice, I will supply the necessary information.

I am, Sir,
Your most obedient servant,
Thomas Vaux.



The important peculiarities of this implement consist—

1st. In each set of tines passing between the other set, and clearing each other of couch-grass, &c.

2nd. In the tines descending the full depth the ground is ploughed; and having two actions, one horizontal, and the other circular or revolving.

3rd. The perfect manner in which it pulverizes the ground, at the same time leaving it as light as it is left by the

plough; for it will be perceived from the drawings, that no substance can escape unbroken larger than the distance at which the tines are from each other when in action, while passing each other.

4th. Separating the couch-grass from the earth, *and raising it to the surface.*

5th. Not requiring to be lifted up to get rid of the couch-grass, &c., as is the case with the drags and harrows now in use. Two defects arise from this lifting up;—First, the manual labour required, the want of which, in due time, creates both an extra quantity of animal labour, and causes the work to be executed in a very imperfect manner, occasioned by the tines being choked with couch-grass. Secondly, the land either entirely or partly escaping the action of the tines when being lifted up for the purpose of getting rid of the couch-grass, and mould too, if the land be not quite dry. In addition to these defects in the old implements, especially after or upon the first ploughing, in strong soils in particular, and on light soils if there be much couch-grass, the tines do not penetrate the full depth that the ground is ploughed; so that it is only after the second and other ploughings, several draggings and harrowings, that these implements do what the revolving harrow performs in the first and every other instance—penetrate quite through the furrow-slice.

6th. The facility with which the tines of the revolving harrow are thrown out of action while turning on the headlands, and for the purpose of travelling from one field to another, are too obvious to require farther explanation.

As to the size, it may, with advantage, be made any breadth, from eighteen inches to five feet; any breadth less than four feet will, however, only be used on particular occasions—that is, when the land is too wet for horses or oxen to travel on the surface. On such occasions, one about eighteen inches wide will be the best, which is so constructed, that it operates upon the newly-ploughed furrow-slice, while the horses walk in the furrow; effected by drawing from the left side of the front or head-piece of the frame, with a cock or shackle similar to those used for ploughs, by which, and with the aid of a wheel attached to the inner frame, which travels in the furrow, the tines are made to operate exactly upon the furrow-slice. This wheel also prevents the tines descending deeper than the plough has gone, while the weight of the harrow causes the tines to penetrate exactly through the furrow-slice, but not deeper. With the harrow in this form, land may be pulverized and cleared of couch-grass (which is the object of all tillage), when so damp that neither the one nor the other could be otherwise accomplished. In fact, land may be completely prepared for seed before a commencement can be made with the common drags and harrows. By attaching a rake, or a small common harrow, to the hind cross-bar, and by picking or raking off the couch immediately after the harrow, a complete fallow may be made without either man or beast setting a foot on the newly-tilled part, and the ground left as light as it is by the plough; while, if in the damp state here alluded to, it were worked with the common drags and harrows, it would be poached, or left *sadder than before it was ploughed;* advantages that will be appreciated by no class of farmers more than by those who raise large quantities of potatoes, mangle-wurzel, Swedish turnips, &c., for which the ground requires tilling long before it is sufficiently dry.

In consequence of the small quantity which *this* harrow is capable of tilling, as compared with a larger, it will only be used when land is not in a fit state to receive the tread of horses; probably, with the exception of land in a very foul state, by acting upon so small a quantity at once, it may be more effectual than a larger.

(*To be continued.*)

SPILBURY'S PATENT IMPROVEMENTS IN PAINTS AND VEHICLES, &c.

(Abstract of Specification.)

(Concluded from p.101.)

As an example of the second vehicle, we take a ley of caustic soda, specific gravity 1.04, to which we add an equal weight of white wax. This mixture is boiled several hours, adding half-a-gallon of water to every pound of wax, after the solution is effected; and we prefer to add four pounds of dry starch, calcined or uncalcined, to each pound of wax; to this vehicle is to be added as much of such pigments, which by previous test are not acted upon prejudicially by an alkaline solution, as shall bring it to the consistency of honey. Reduce this mixture to a proper state for painting, by the addition of soft water, the softer the better; and when the surface painted with it is dry, wash over, as before, with a solution of alum, or other chemical agent, which is known to destroy the combination of

wax and an alkali, leaving the wax insoluble in water. It is obvious that the above vehicles may be used in combination with each other, as well as separately.

Another mode of employing gelatine, and the other vehicles described, for fixing paints or pigments, is to apply a coating of either of the vehicles, over a painted or printed surface, and then subsequently fixing the vehicles by a chemical solution, as above described; by this means paints or pigments may be set, without the necessity of putting the abovementioned vehicles in the paint or pigment, before using the same.

Another form of our invention is, to mix pigments with sulphate of zinc, or other preservative material, as described above, but without any vehicle, directing the painter to supply the necessary gelatine; the object of this mode is, to enable the mixture with gelatine, when made, to keep a reasonable time in hot weather, at the same time, that not being mixed till wanted, the pigments can be kept an unlimited time. This mode of preparation is particularly applicable for hot climates.

We would in conclusion remark, that we believe the best vehicles to be employed, are gelatine and albumen, and, as above stated, that the best chemical agent known for rendering the soluble vehicles herein described insoluble, is alum.

It may be desirable to state, that pigments and vehicles, treated according to our invention, are applicable in *printing and painting paper and other fabrics, as well as other surfaces*, using pigments and vehicles according to our invention, in place of pursuing the means heretofore resorted to. And we have found, that in using a solution of alum as the fixing material, that it is desirable to apply a small quantity of dissolved starch (say a hundredth part of the solution), by which the same will work better, and not be liable to run when laying it on.

Another part of our invention relates to a mode of applying certain vegetable matters in the preparation and application of paints or pigments. For this part of our invention, the glutinous or adhesive products of vegetable matters generally will do, but we prefer gluten, albumen, gums, mucilage; these may be used either separate or in combination with other products usually found therewith. For example, we take flour mixed with water in such proportions as to form, when boiled, a mixture about the consistency of cream, with this liquid the pigment is to be ground to the state of paint, with or without sulphate of zinc or other preservative, as described in the preceding part of our specification. This paint or pigment, if necessary, is to be reduced with water, and is to be laid on in the usual manner, and when dry, may, according to our invention, be fixed by an application of a suitable chemical agent or re-agent. We prefer silicate of potassa or of soda, commonly called liquor of flint, or other chemical agent, known to render such vegetable products insoluble in water; and we would remark, that we dilute the liquor of flint as much as possible, so long as the liquor will have the desired effect of fixing and rendering the paint on the surfaces insoluble by water; which is readily tested, by laying a small quantity of the pigment or paint prepared with a soluble vehicle intended to be used, and, when dry, by applying the liquor, and letting the same dry for forty-eight hours, when, by washing the surface, it will be seen whether the strength of the liquor used has been sufficient; and if so, the same strength of liquor will do for the same pigment or paint, and vehicle.

We will give another mode of carrying out this part of our invention with effect:—We take any quantity of dissolved tragacanth, of the consistency of linseed oil, which we mix with as strong a solution of silicate of potassa or of soda, which, by previous test, is not found to injure the colour to be employed; with this mixture the paint or pigment is to be brought to a proper consistency for working, and then applied, in the usual way, to surfaces; and, when well dried, the same will allow of being washed and cleansed, owing to the paint on the surface being insoluble in water.

REMARKS ON FRENCH HOUSES AND VENTILATION.

That there are comfortable and weather-tight houses in France, both public and private, cannot be denied by the most fastidious judges of comfort; but, that 999 out of every 1000, throughout the country, are neither comfortable nor weather-tight, is a fact equally indisputable. There is one feature in the construction of them, indeed, which militates against comfort, and that is, the absurd practice of making windows on each side of the rooms where the houses are single; so that, independently of the inconvenience of what is called a cross-light, very annoying to the eyesight, and causing a constant draught of cold air in the winter, there is little respite from the piercing rays of the sun

in the summer solstice. If denied admission on one side, he is sure to make his appearance on the other; so that a cool room, under such circumstances, is not to be looked for at any hour of the day in the dog-days. But, in double houses (which, I am happy to say, mine is), the windows will rarely resist a storm of beating rain; and as to being anything like air-tight, that is not to be expected from their construction and materials. Then the glass is so thin (but it is cheap), that a friend of mine, residing here, declares the wind finds its way through it; and I see no reason to doubt its doing so. There is one security against beating rains and driving snow, in French houses, which is worthy of imitating in all exposed situations, and that is, the open-barred outside shutters to all the upper windows. Neither are they merely a security against bad weather—they contribute to the safety of the inmates, and would be desirable safegnards to all low houses in England, situated apart from others, and, consequently, less secure. And yet, with all these cracks and crevices in windows and doors, together with the uncalled-for number of the latter, I think the French do not take so much pains to ventilate their apartments as we do in England; and, even with us, more would be desirable. Step into the inner apartment of a French shopkeeper, and you are at once convinced of the truth of my remark, and also of that of Mrs. Hamilton, in her amusing tale of "The Cottagers of Glenburnine," that air is a luxury only understood by the better orders. Thus she makes the old Scotch dame remark, with satisfaction, that the air can never "have *won* into her sleeping-apartment." Did people, however, put the proper value on ventilation of apartments, as regards health, it would be more attended to than it is; of which the following fact is a proof:—Some years back, no less a number than 2944 infants, out of 7650, died in the Dublin Lying-in-Hospital, in the space of four years, within a fortnight after their birth! It was discovered that this circumstance arose from the want of a sufficient quantity of good air. The hospital was therefore completely ventilated, and the proportion of deaths was reduced to 279; so that out of the 2,944 who had perished in the four preceding years, no less a number than 2655 had perished, if not solely, nearly so, from the foulness of the air; in my own experience, I can speak to the good effects of ventilation. I have been nearly forty years a housekeeper, without ever having had anything like a malignant disease in my house. I attribute this blessing, in great part, to a rigid observance of my orders, that bedroom-windows (others of course) should be left open the greater part of the day, in all seasons of the year; that no bed should be made for at least three hours after it has been occupied; and that, previously to its being made, all the clothes belonging to it shall be exposed, separately, to the air. Nothing is more likely to produce disease than beds made before they become cool and well-aired.—*Nimrod in France.*

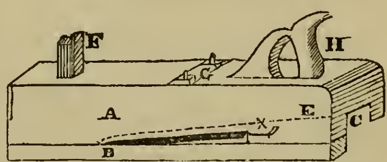
MOSS'S MATCH-PLANE.

To the Editor of the Mechanic and Chemist.

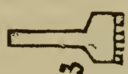
Sir,—In your valuable Magazine, I see that a correspondent "S. G. H." in Vol. VI., No. 1, wishes to know how Lucifer matches are cut. I made a plane for cutting them, which answers exceedingly well, and with which I could cut 500 or more per minute by manual labour. The length of wood I find the best to cut, is eighteen or twenty inches long, and two inches thick, which can be cut easily; the matches dropping out in shreds behind, which can be cut to any length required.

Description.—Fig. 1, A, side; B, fence screwed on; C, end from where the matches come, after being cut; D, position of the iron; E, dotted line, showing the

Fig. 1.



depth of space over the iron; F, cutter and wedge; G, two screw bolts, to fasten the iron in its place; H, handle.



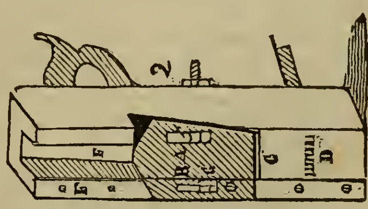


Fig. 2, A, iron; B B, two slot holes for

screw bolts; C, mouth; D, cutter; E, space for matches; F, fence screwed on; G, hole cut through the fence to admit the head of screw bolt.

Fig. 3, cutter.

In making the plane, let the iron be put about the same as the black line, D, fig. 1, the contrary way, so as to have the face of the iron downwards, and the bevel next the plane; so that when it works, the matches will go over the bevel of the iron, and come out behind.

The one that I have is 18 inches long, $3\frac{3}{4}$ inches broad, $2\frac{3}{4}$ inches deep fence; $\frac{3}{4}$ inch, deep screwed on, with the hole behind, two inches wide, the iron covering the whole of the face; and the two pieces left on each side of the hole, serve to bed the iron upon. The slot hole in the iron to be cut two inches apart in the clear, so that a two-inch shaving will go between the screws; and, to cut a strong shaving, slacken your screws, and knock the iron behind, which will cause it to cut strong. The cutter I have, slits the shaving into fourteen pieces; but any quantity of cutters can be added to the plane; the cutters acting before the iron slit the shaving into the required sizes. Take the cutter out, and you have a shaving according to the breadth of wood cut, of which you can make your boxes. W. Moss.

Birmingham.

THE CHEMIST.

CHEMICAL ANALYSIS.

(*Continued from page 87.*)

Having described the peculiar characteristics of the gases which are most common, or, at least, are more frequently met with in the course of observation than any others, I now propose describing the method of ascertaining the quantity of any peculiar gas when combined with many others. The most usual way of effecting this, is by means of specific gravity. We will take, for example, a mixture of carbonic oxide, subcarburetted hydrogen, and olefiant gas: 100 measures of this mixture being known to contain carbonic oxide, subcarburetted hydrogen, and olefiant gas, we desire to know the proportions of each. The rule is as follows:—The specific gravity of carbonic oxide and carburetted hydrogen or olefiant gas, being the same, viz. 0.972, the first step is, to ascertain their quantity.

Multiply by 100 the difference between the specific gravity of the mixture under consideration, which is 0.638, and the lighter gas or subcarburetted hydrogen, which 0.555. Then divide that number by the sum of the differences of the specific gravity of the mixture, and that of the lighter and denser gas; the per centage of the denser is the quotient. (Vide *Gregory's Mechanics*, Vol. I., page 365.)

For example, we take this mixture, the specific gravity of which is 0.638, and desire to know the proportion per cent. of the two denser gases.

Specific gravity of subcarburetted hydrogen is, 0.555. Then $0.638 - 0.555 = 0.083$ and $100 \times 0.083 = 8.3$.

$$\left.\begin{array}{l} 0.972 \\ 0.638 \\ 0.555 \end{array} \begin{array}{l} \text{difference } 0.334 \\ \text{difference } 0.083 \end{array}\right\} = 0.417.$$

And $\dfrac{8.3}{0.417} = 20$ (nearly.)

which is equal to the volume of the two heavier gases; therefore there are eighty of the lighter or subcarburetted hydrogen. Now fire the whole with oxygen, and allow 160 of oxygen for saturating the 80 measures of the subcarburetted hydrogen. Then, previously knowing that the saturating power of olefiant gas and carbonic oxide with oxygen, is in the ratio of 3 to 0.5, we will suppose that, in the explosion, 35 cubic inches more of oxygen to have been consumed. Then the quantity of olefiant gas is,

$$= \frac{35 - (20 \times 0.5)}{3 - 0.5} = \frac{25}{2.5} = 10 \text{ measures.}$$

We see, therefore, that this mixture of the specific gravity 0.638, consisted of

0.8	measures	subcarb. hydrog.	= 0.444
0.1	ditto	carbonic oxide	= 0.097
0.1	ditto	olefiant gas	= 0.097
			0.638

MM. Arago and Biot, as well as Sir H. Davy, from experiments upon ammoniacal gas, have determined the specific gravity to be 0.5902; this has been ingeniously employed by some chemists to ascertain the specific gravity of hydrogen, which they have deduced as 0.0694. Their manner of proceeding is as follows:—It being known that two volumes of ammoniacal gas are resolvable into four volumes of constituent gases, viz. 3 hydrogen and 1 nitrogen, you double the specific gravity of the ammonia, viz. 0.5902, and subtract the specific gravity of azote, viz. 0.9722; the remainder divided by 3, will give the specific gravity of the hydrogen in algebraical form thus: — The sum of the

weights being divided by the sum of the volumes, gives the specific gravity of the mixture. Let x be the specific gravity of hydrogen;

Then $\frac{3x + 0.9722}{2} = 0.5902$ the specific gravity of ammonia.

Whence $x = \frac{2 \times 0.5902 - 0.9722}{3} = 0.0694$ specific gravity of hydrogen.

To ascertain the Specific Gravity of a Gas.—Poise a globe which has a stop cock attached to it and open, at the end of a balance; note its weight; then exhaust it by the air-pump and weigh it again; the difference of the two weighings is the apparent weight of the atmospheric air previously contained in it. This should be repeated three times, and the mean of the three trials is to be taken. We now attach, by means of the screw stop-cock, the globe unto an air-jar or gasometer, in which is the gas to be examined, and which must have been previously desiccated by chloride of calcium over lime; now open the communication, and allow the gas to enter, till there is established an equilibrium of pressure with the atmosphere. In transferring the gases, the globe must not be sustained by the hand, but be left dependent upon the connecting screw. Observe, also, that the mercury is on a level, both inside and outside the jar. The globe is now again to be poised upon the balance, and the weight of the included gas ascertained, which, being divided by the weight of the air formerly noted, gives a quotient, which is the specific gravity of the gas required. When great precision is required, the globe should be again exhausted, and the same process repeated a second or even a third time; and it is expedient, after ascertaining the specific gravity of the gas, to reweigh the atmospheric air, lest, during the experiment, its temperature or pressure may have changed.

From experiments by Mr. Faraday, it appears that gases which are not absorbed by water, are kept more perfectly from being contaminated by the atmospheric air, by leaving the jars containing them inverted in *water*, than if they were so over *mercury*; as, in that case, the filtration is not through the pores of the mercury, but along the surface of the glass; but before they are weighed, the air and water should be brought to the same degree of temperature.

To reduce the volume of a gas at any certain pressure to what it would be under the mean pressure of thirty inches of mercury, multiply by the particular barometrical pressure the volume of the gas, divide that product by thirty, and the quotient is the true volume.

MISCELLANEA.

Protoxide of Lead found in the Animal Tissues.—M. Tanquerel Desplanches has shown, that the skins of animals submitted to hydro-sulphuretted baths, acquire a black tint, indicating the presence of a compound of lead in the tissues. From hospital statistics it is ascertained, that forty-seven men working in lead compounds, died during the years 1833-34-35-36-37. M. Laissainge considers that it would be of the greatest importance to discover the presence of oxide of lead in the tissues of subjects working in lead manufactories. Some experiments have been made, but without success.—*Journ. de Chemie Medicale.*

Heat produced by Slacking Lime.—In the 23rd tome of the *Annales de Chemie et de Physique*, I observed there were some experiments instituted for the purpose of ascertaining whether the heat given out during the slacking of lime, was sufficient to fire gunpowder. "A small quantity of it was put into a glass tube hermetically sealed at one end, and was then placed in slacking lime. Some minutes elapsed without any effect being perceived, except the volatization of some of the sulphur contained in the powder; but at length a loud explosion took place, however, without breaking the tube." I have made since a few experiments respecting the length of time and temperature required to explode some other chemical combinations, the results of which are as follow:—

	Fahr.	Minutes.
Hall's gunpowder	510°	7
Iodide of nitrogen........	112	1.5
Fulminating mercury	119	2.25
Common fulminating powder	525	8.15
Fulminating gold	105	2.75

Each was immersed a depth of one foot in the lime; and the thermometer had between it and the tube containing the mixture, a partition of the lime about one inch thick. As soon as the explosion had taken place, the lime was immediately removed from around the thermometer, that the temperature might be observed. The tube was broke by the iodide of nitrogen, and the common fulminating powder only. Query, might not unslacked lime be used for the firing of gunpowder in submarine operations?

MANIPULATOR.

To Turn the Hair Black.—Mix pomatum with pearl white (precipitated bismuth); this will turn the hair black.

A Depilatory.—Quicklime, one ounce; orpiment, three drachms; orrice, two drachms; nitre, one drachm; sulphur, one drachm; soaplees, half-a-pint. Evaporate to a proper consistence.

Another.—Lime, twelve ounces; starch, ten ounces; orpiment, one ounce. Mix.

Extemporaneous Aromatic Vinegar.—Acetate

of potassa, one drachm; essence of lemon, three drops; sulphuric acid, twenty drops.

Cold Cream.—Oil of almonds, one pound; white wax, four ounces; melt and pour into a warm basin, then add by degrees rose-water, one pound.

Powerful Antiseptic.—Nitrate of silver is the most powerful antiseptic known. One ounce dissolved in 12,000 ounces of water, will preserve the water from putrefaction for ever; and it may easily be separated therefrom, by adding common salt, which will precipitate the silver in the form of a chloride.

Indelible Purple Ink.—Dissolve in distilled water some crystals of the nitro-muriate of gold. Write therewith, and expose the writing to the sun, it will instantly change to an indelible purple.

Bug Poison. — Corrosive sublimate, two drachms; spirits of wine, eight ounces; rub together, and add oil of turpentine, eight ounces.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 5, E. W. Brayley, Jun, Esq., on Igneous Geology. Friday, Aug. 7, J. Smith, Esq., on Provident Institutions. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Aug. 6, J. H. Pepper, Esq., on Phosphorus and its Compounds. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 5, Mr. Thomas Wiglesworth, on the Properties of Bones. At eight o'clock.

QUERIES.

By what means could I take off the alkaline smell of soap preparatory to scenting it? It seems as if alkalies had the power of absorbing scent; for it requires an immense quantity to be put in, before any smell of pleasant odour can be perceived. G. H. W.

1. What is the arrangement in the battery called "Smee's battery?" 2. What compositions will produce purple fires? 3. What is the liquid used in producing the fire cloud? 4. By what means may zinc be reduced to a fine powder? F.

ANSWERS TO QUERIES.

To Clean Paper Walls.—Rub them with the crusts of a stale loaf, having some of the crumb on them.

Tutenague, white copper, or pak fong, is a compound metal brought from China, and contains 15 nickel, 28 zinc, and 21 copper. Is malleable.

To make Rice Glue.—Mix rice flour intimately with cold water, then gently boil it. It is beautifully white, dries almost transparent, and is in every respect superior to paste made of wheaten flour.

To make German Paste for Birds.—Take pea meal, two pounds; blanched sweet almonds, one pound; fresh butter, three ounces; beat together, then add a little honey and cake saffron shred. Pass through a colander to granulate it. Some, put in the yolks of two eggs; but this makes it too expensive and too fattening for the birds. It will keep good six months.

TO CORRESPONDENTS.

Arnold Boulter.—*Both air and fire balloons (especially the former) must be made extremely light, when of small dimensions. For a smal lfire balloon, from two to three feet in height, take thin tissue paper, joined by paste in light and narrow seams; fill a small piece of sponge with oil of turpentine, and attach it at the orifice of the balloon by means of very thin wire. When it is lighted, if care be taken to prevent the flame from coming in contact with the paper, the balloon will infallibly ascend. For a small air balloon, hydrogen should be employed in preference to the coal gas, the latter being heavier, and, consequently, lessening the ascending power. Hydrogen gas may easily be procured, by putting sulphuric acid (oil of vitriol) in a bottle with iron filings or pieces of zinc, and adding water till a great effervescence takes place. The gas may be collected in a bladder tied to the neck of the bottle.*

J. M. K.—*We will endeavour to obtain the best information on the subjects of his queries.*

J. Hilton *should write to some of the publications which treat on medicine.*

A Subscriber *and others, who have addressed to us questions concerning manganese, in our next.*

L. H. W.—*The best advice we can give is, that he should forthwith publish his invention without reserve. The Society of Arts can afford him but slender aid, even if he has friends enough to procure him their patronage; and, as for the Royal Society, he might as well consign his model to the bottom of a well, or lay it on the table of the House of Commons; for if he sends it there, it will never see day-light again, unless our correspondent is prepared to spend five or six years in attending upon the council, and eating muffins with the president; then, indeed, at the small charge of a few dozen brace of pheasants sent at the proper season, and to the proper quarters, his communication may possibly be read; but the Royal Society of London have declared and publicly proclaimed their determination,* never to express an opinion upon anything; *and when the thanks of this extraordinary body is occasionally awarded for some remarkable communication, it is to be considered only as an act of politeness and courtesy towards the person who introduces it, without any reference to nature or merit of the communication itself!*

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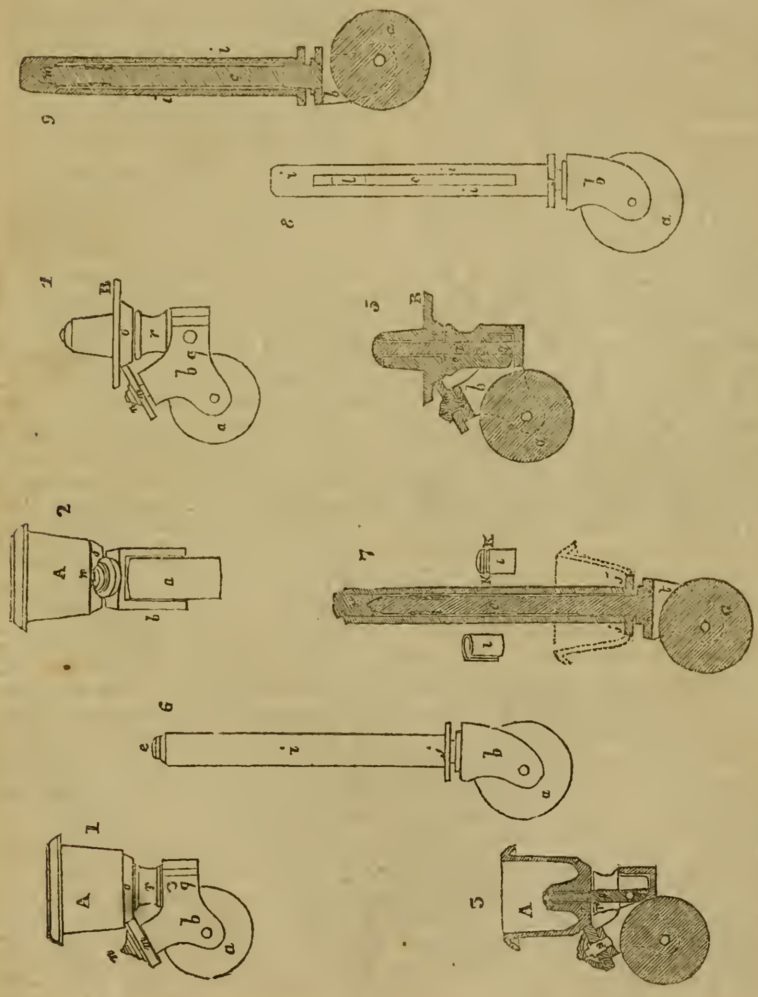
HARCOURT'S PATENT CASTORS.



City Press, 1, Long Lane: Doudney and Scrymgour.

HARCOURT'S PATENT CASTORS.

(*Abstract of Specification.*)

Description of the Drawing.

Fig. 1 represents a side view of a socket-castor, constructed according to the first part of my invention.

Fig. 2 is a front view thereof; and

Fig. 3 is a section of fig. 1.

And in order to show that plate-castors may be made according to this part of my invention,

Fig. 4 is a side view; and

Fig. 5 a section of a plate-castor, similar in construction to fig. 1, excepting in respect to the means of applying castors to furniture; the one being a socket-castor, the other being a plate-castor, and the parts are marked with the same letters of reference. *a* is the wheel or roller, moving on an axis, carried by the frame, or what is commonly called the horn, *b*, the nature of which is clearly shown in the drawing; A is the socket of the castor, fig. 1, and B is the plate of the castor, fig. 4, by which the castors are respectively affixed. The horn or frame, *b*, is capable of movement on an axis, *q*, which axis passes through the pin, *p*, which is carried by the socket in the plate, B, as is shown in the drawing, but is capable of turning freely; *r* is an external ornamental covering and support of the lower part of the pin, *p*; and such covering constitutes the standard between the horn or frame, *b*, and the plate, B, or the socket, A, as are respectively shown in the various figures of the drawing under description. The frame, *b*, carries a friction-wheel, *m*, which moves on an axis, *n*; this friction-wheel moves against the circular inclined track, O, consequently it will be seen, that the pressure on the pin, *p*, will have a tendency to force the horn or frame downwards towards the ground, at the point where the horn, *b*, is connected to the pin, *p*; but such pressure will keep the wheel, *m*, in contact with the track, O, and thus relieve the pressure on the pin, *p*.

I will now proceed to describe the second part of my invention; in doing so I would remark, that the same has for its object various constructions of bearings of the main-pin or axis on which the castor turns; and by means of such improvements I am enabled to construct castors with much greater length of main-pin or axis, by which the weights carried by such castors are more advantageously borne or carried, and the castors are rendered less liable to the prejudicial action of strains.

Fig. 6 is a side view; and

Fig. 7 is a section of a castor, constructed according to this part of my invention; *a* is the ordinary wheel or roller, moving on an axis, carried by the frame or horn, *b*, and this horn has the main-pin or axis, *c*, affixed thereto; and it will be seen that this pin or axis, *c*, is much longer than those heretofore used, by which the main point of bearing is carried up a considerable height within the leg of the piece of furniture to which such castor is applied, which will be found very advantageous in the construction of castors; and it is this circumstance of great increase of length of the main-pin or axis on which the castor turns, when combined with either of the constructions of apparatus and bearings, and means of applying the same, that constitutes the second part of my invention. *i* is a tube, within which the axis or pin, *c*, moves freely, it being so made as only to touch at the lower part of the tube; the conical part at the upper end, entering a conical hole in the piece of metal introduced or applied and affixed into the upper end of the tube, *i*, or the end of the tube may be welded together to form the end bearing, *e*. I would remark, that I prefer that the piece of metal, *e*, should be of iron, case-hardened; but other materials may be used. The tube, *i*, according to one mode of construction, is made of plate-metal, having a flange or circular plate, *j*, affixed, by brazing or otherwise, to the lower end; and this plate may be used in like manner to plate-castors; or in place thereof, a socket may be applied of brass or other suitable material, as is shown by dotted lines in fig. 7. At the same time I would remark, that in using such long axes and tubes for bearing, the simple act of making the holes in the furniture of such a size as to require the tubes to be slightly driven, will be holding enough without screws. The piece of iron, *e*, is affixed by means of a groove, *k*, formed therein, into which the end of the tube is turned or hammered; or it may be fixed by brazing or by other convenient means. By this mode of constructing a tube, *i*, combined with the upper bearing, *e*, it will be evident that the main-pin, *c*, may be of any desired length, by which the main point of pressure on to the castor will be at a considerable height above the roller; and it will be evident, that where the castors are larger than that shown in the drawing, the main-pin or axis, *c*, may with advantage be made longer; but for the size given in the drawing, I consider the length of tube which carries the bearing, *e*, to be a convenient and proper length, but I do not confine myself thereto. In the

pin, *c*, is formed a groove which receives a hoop-spring, *b*, the object of which is to retain the axis in its place, and at the same time will allow of its easy turning in the tube, as will readily be understood on examining the drawing. The tube, *i*, may be made of any suitable sheet metal strong enough for the purpose, and which can readily be made into a tube. I prefer wrought iron for the purpose. Another mode of making the tube is of cast iron or malleable cast iron or cast brass, by casting it in a suitable mould, as is well understood in casting tubes in such metal; but when the tube, *i*, is cast, I apply the piece of metal, *e*, by brazing or by pinning, as the cast iron will not allow of hammering the upper end thereof into a groove, as plate metals will. In using malleable cast-iron when the same is annealed, as is well understood, it may either be hammered into a groove, as above described, or it may be affixed to the bearing piece, *c*, by brazing or other convenient means. It should, however, be understood, that this part of the invention does not relate to any new mode of making tubes, but only relates to the making of suitable tubes to carry the bearings, *e*, which are to be applied to such tubes at a considerable distance from the castors with which they are combined. Another part of my invention relates to combining certain cast-iron or cast malleable-iron frames for carrying a suitable bearing, *e*; but in the present instance the bearings, *e*, are not applied to the tubes after they are formed, as is the case when using the cast tubes above mentioned; but such bearings are cast of the same metal as the frames which carry them, and this part of the invention may be said to consist in the application of bearings, *e*, cast frames, in order that such bearings, *e*, may be at a considerable distance above the castors or rollers thereof; and such frames could not be made in like manner to the short tubes now in use, which are cast vertically on metal cores. The mode of constructing the frame, *i*, consists in making a tube, *i*, in iron or brass, or other suitable material to be used as the model of the frame, to be cast therefrom; and as it is difficult to have the end, *e*, cast thereon, which is to constitute the bearing, *e*, when the inner core is supported only at one end. I remove a portion of one or two sides of the model for two or three inches in the length, in such manner as to produce long openings into the tube; by this means, when the interior of the tube is filled with a cylindrical pin, the arcs of the circle of such cylindrical pin will protrude; hence when the model tube with its flange is pressed into the sand to form a mould, the sand will fill up the portions of the model where it is cut away, and the inner core or pin will make a slight recess in the sand, the object of which is, to receive and support the proper sand core; and by such recess the sand core will be supported for a considerable part of its length, and thus may any desired and suitable length of tube be cast with an end, *e*, thereto, as is shown at fig. 8; and it will only be desirable farther to remark, that in order to complete such tubes when cast (and if they be of malleable cast-iron, they are to be annealed, as is well understood in working with such metal), they are put into a lathe, and the lower side of the flanch faced, and, by a suitable drill, the bearing, *e*, is to be formed. Another part of my invention relates to the application of a complete cast tube, *i*, of the required length, so as to dispense with holes for screws; and in making such tube, *i*, the sand core is of such a length, that it may be embedded at its outer end in sand to such an extent, as not to require support beyond the flanched end of the tube, *i*; by this means a complete tube may be cast, as shown at fig. 9, with the end, *e*, thereon, and the flanch having no holes for screws, the length of tube enabling it to be fixed without screws; the tube is then to be finished as last above explained. It should be stated that, in making sand cores for the interior of the tubes, I place a wire in each core to give and branch thereto, as is well understood by moulders. I would remark, that there is an advantage in using malleable iron for the frames, and for the tubes, *i*, as the ends, *e*, can be tempered or hardened, and thus be more lasting.

VAUX'S PATENT REVOLVING HARROW.

(Concluded from p. 107.)

As to the dimensions of the larger sort, every farmer may exercise his own discretion: from four to five feet wide will probably prove the best. In using these harrows on stiff soils, or on light soils full of couch-grass, it may be necessary to take out every other tine from the nave of the front set—being fastened by bolts and screws, this will be easily accomplished without the aid of a smith; or one set of tines with the nave may be taken off the axle, and the rest adjusted.

There is a provision for throwing nearly the whole weight of the outer frame upon

the tines, by placing the bolt attached to the upright part of the frame, on the opposite side of the spoke of the wheel to that on which it is placed for the purpose of keeping them out of action, when they do not penetrate through the furrow-slice, which may be the case on very stiff or foul soils when not quite dry.

As to the management, nothing more is required than to raise the tines out of action, and to let them down at every turning, which is done by turning the hand-wheel once round and placing a bolt, provided for the purpose, behind a spoke of the wheel.

It is necessary to observe, that the tines should always be raised out of action before the front wheels begin to turn on the headland, otherwise they will be bent. The superiority of the revolving harrow over those now in use, may easily be comprehended, both as to the power necessary to accomplish the object required, and the effect produced, by supposing a man to place a three-pronged dung-fork at one side of a piece of ploughed ground, and try the difference of the force required to push it through in the same manner that the tines of a drag are forced through; then let him with the same tool, fork the ground over in the ordinary way, and it will be perceived, that forcing the fork through may be compared to the manner in which the old drag performs its operations, and that of forking over the ground to the work of the revolving harrow. This is so obvious, that on ground which requires four ploughings (the average number independent of the seed furrow), dragging, and numerous harrowings with the old implements, to make a fallow, may be as effectually prepared by two ploughings, and less than half the draggings and harrowings* with this harrow; consequently will be a saving, in a very short time, of a sum far exceeding the cost of this implement.

The materials of which these harrows are constructed, consist of the best wrought and cast iron, the former being as three to one of the latter; part of the frame-work may, however, be constructed of wood, which will greatly reduce the cost.

The weight will vary from about 5 to 15 cwt.

* I say draggings and harrowings, because the revolving harrow answers all the purposes, at one operation, of a spiked roller, the heaviest drag, and the lightest harrow of the common sort; it will, therefore, be found a valuable acquisition on those occasions in which it is desired to break the furrow-slice of ley, clover, and other stubbles.

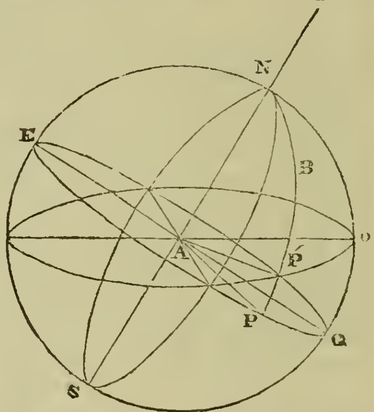
Country smiths will, on application to Mr. Daniel Green, No. 36, King William Street, London Bridge, agent to the patentee, be supplied with castings, and licence to manufacture.

The revolving harrow may also be had of Messrs. Gibbs, seedsmen, Half-moon Street, Piccadilly.

ON THE CONSTRUCTION OF SUNDIALS.

The whole theory of dialling depends on this one principle—that the sun revolves about a sphere fixed to any part of the earth, in the same manner that it does about the earth itself.* Thus, if we construct a globe, and mark upon it meridians, an equator, &c., and place it so that its axis may be parallel with the axis of the earth, the same phenomena of light and darkness will be observed upon this globe as upon the earth itself.

Thus let N E A Q S, fig. 1, be a sphere, having its axis,



N S, parallel to the axis of the earth, then E Q, the plane of its equator, will also be parallel to the plane of the terrestrial equator; and let H O be a horizontal plane, drawn through the centre, A. Then let its axis be produced; that is, a pin driven in at its north pole, N, in the same right line as the axis of the sphere. Then if the sun be supposed to revolve round this globe, it will cast a shadow of the pin, A B, upon the surface of the globe, as shown at N B in the figure.

* In this statement, we do not mean the *real* but the *apparent* motion of the sun.

Then as there are 360 degrees in the whole circumference of the great circle, E A Q, and as the sun takes twenty-four hours to revolve round the earth, there must necessarily be fifteen degrees described for each hour that the sun continues its revolution. Then if the circle, N H S Q, be supposed to be the meridian of the place, and as the sun is always on the meridian at noon or twelve o'clock, it is evident that the angle, Q N P, measures the time from noon of the shadow of the pin falling at N P.

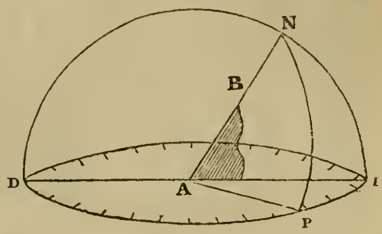
Now if the whole sphere be supposed to become transparent, and an opaque plane be supposed to be drawn through its centre parallel to the terrestrial equator, the shadow of the pin, A B, will be shown in that plane in the direction A P, the angle, Q N P, or arc, P Q, denoting the time from noon. Thus the simplest form of dial is one whose plane is parallel to the terrestrial equator, and, therefore, the *hour angles* (that is. the angles described in each hour) must be each equal to 15°.*

Then if we wish to construct a dial having a face in any other direction, we have only to draw a plane in that direction through the centre, A, and to see where the line, N P, cuts this plane (as at P′ in the plane, H A O), and the distance from that point to the meridian, reckoned in that plane, will denote the same hour as the distance, P Q, in the former plane.

We now proceed to investigate the cases where the planes are horizontal, and those where they are due north, south, east, and west.

Let D I (fig. 2) represent the *horizontal* plane, upon which we wish to construct the dial. Let I be the point from which the hours are to be measured, that is, the point on which the shadow falls at noon. Let A B represent the stile or pin of the dial; then as D I is horizontal, and N A parallel to the axis of the earth, we have I N equal latitude of the place for which the dial is to be constructed; that is, $\angle$ N A I = latitude of place. Let this be denoted by λ; also the angle, I N P, measures the space passed over by the sun in

FIG. 2.



a given time; let this be denoted by h; whence, in the spherical triangle, N P I, we have,

$$\angle \text{NIP} = 90^\circ$$
$$\angle \text{LNP} = h$$
$$\& \text{ IN} = \lambda.$$

Whence, by Napier's formula,

$$\text{Sin. NI} = \text{tan. PI cot. PNI};$$
$$\text{Or, sin. } \lambda = \text{tan. PI cot. } h;$$
$$\therefore \text{tan. PI} = \text{sin. } \lambda \text{ tan. } h.$$

Or, by putting h successively, equal to 15°, 30°, &c , we get the different angles N which the hour lines must make with the line, A I, at a given latitude (λ).

Let this latitude be that of Greenwich = 51° 29′ N; then if we put PI = H, we have

(1.) Tan. H = sin. 51° 29′ . tan. 15° = tan. 11° 50′

(2.) Tan. H = sin. 51° 29′ . tan. 30° = tan. 24° 18′

(3.) Tan. H = sin. 51° 29′ . tan. 45° = tan. 38° 2′

(4.) Tan. H = sin. 51° 29′ . tan. 60° = tan. 53° 35′

(5.) Tan. H = sin. 51° 29′ . tan. 75° = tan. 71° 6′

(6.) Tan. H = sin. 51° 29′ . tan. 90° = tan. 90°

(7.) Tan. H = sin. 51° 29′ . tan. 105° = tan. 108° 54′

(8.) Tan. H = sin. 51° 29′ . tan. 120° = tan. 126° 25′

(9.) Tan. H = sin. 51° 29′ . tan. 135° = tan. 141° 58′

(10.) Tan. H = sin. 51° 29′ . tan. 150° = tan. 156° 42′

(11.) Tan. H = sin. 51° 29′ . tan. 165° = tan. 168° 10′

(12.) Tan. H = sin. 51° 29′ . tan. 180° = tan. 180°

Whence, for

* The practical objection to this construction is, that it shows the time only six months in the year, that is, during the summer months, when the sun is north of the equator. When the sun is south of the equator, the under side of such plane would be illuminated, consequently the shadow of the stile could not be projected on the upper surface; also at the equinoxes, the sun's rays being parallel with the plane of the dial, the edge only will be illuminated, and the shadow will fall on neither side, supposing a stile to be fixed to the under as well as the upper surface.—ED.

P.M.	A.M.		°	′
Noon or 12		the angle, I A P, must be	0	0
1	— 11		11	50
2	— 10		24	18
3	— 9		38	2
4	— 8		58	35
5	— 7		71	6
6	— 6		90	0
7	— 5		108	54
8	— 4		126	25
9	— 3		141	58
10	— 2		155	42
11	— 1		168	10
12	— midnight		180	0

(*To be continued.*)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 103.)

THE chapel of Our Lady, usually called Beauchamp Chapel, adjoining the south chancel of St. Mary's Church, is a beautiful specimen of the florid Gothic style of architecture, and well deserves the attention of the traveller. The church of St. Nicholas is a modern Gothic building.

GUY'S CLIFF is about a mile and a half from Warwick; it is a most romantic and attractive spot, said to have been the retreat of the champion Guy, after his battle with Colebrand the Dane.

KENILWORTH is a small market town of Saxon origin, 95 miles from London, and about five miles from Warwick and Coventry. The castle, though now a ruin, exhibits relics of former strength and grandeur; and the many historical events connected with it are impressed upon the mind by the great reviver of history, Sir Walter Scott, whose genius illuminated every subject and every event which his prolific pen has recorded.

STRATFORD-UPON-AVON was a place of some importance 300 years before the Conquest. It contains, besides other remarkable edifices, a church, elegantly decorated, and approached by an avenue of lime-trees, whose overhanging branches chase the wanton sun beams from the solemn place, and twine together like the arms of angels, watching over some adored and kindred spirit; the pensive pilgrim moves slowly on in silent awe and reverence, more deep, and more sincere, than ever Moslem felt at Mecca's shrine—

> " And thereby hangs a tale."

Seven cities contended for the honour of giving birth to the prince of Greek poets: Mantua, Sulmo, and Venusium, glory in their Latin bards; and every age has been adorned by the bright lustre of genius—some fleeting as the meteor that dazzles for a moment, and then vanishes in the mists of night; others, mighty as the celestial fire that cleaves the massive rock, and leaves to after ages traces that no human hand can efface; but " the Bard of Avon" stands alone and unrivalled in his glory; he was not the poet of an age or of a nation, but an incarnation of the genius of poetry—the world was his school, and nature his book. To him, the secret workings of the human mind were as familiar as the deepest mysteries of science; and the melody of his numbers is not more admirable than the profundity of his discourse. Men may marvel to see so much wisdom spring from an unknown source, without the aid of human teachers; but his mission was to teach, not to be taught—to enlighten the world, not to borrow from the dim tapers that preceded him; and this is a mystery known only to the genius that possessed him.

> Scit genius, natale comes qui temperat astrum,
> Naturæ deus humanæ, mortalis in unum—
> Quodqe caput: vultu mutabilis, albus, et ater.
> HOR. Ep. 2.

Genius, poet, angel, or whatsoever he was, we shall never look upon his like again.

Shakspeare was born at Stratford in 1564; and, after accomplishing his high mission, departed from this world in 1616, leaving his mortal remains deposited in this church, where they still remain undisturbed.

Sweet bard! look down with mercy on the presumptuous hand that dares to scan thy greatness!

From the Coventry station, the railway passes through a cutting, and afterwards upon an embankment, from which a good view of the country is obtained, and another cutting to Beechwood Bridge, a beautiful structure, seventy-six feet span, and rising only seven feet six inches in the centre. A short distance beyond this, is Beechwell Tunnel, 160 yards in length, with an entrance in the Egyptian style of architecture. Four miles farther is the

HAMPTON STATION, an intermediate one, 102½ from London, and 9¾ from Birmingham.

The Birmingham and Derby Junction Railway branches off from this place. Here the line commences a gradual ascent, which continues about seven miles, passing under the London and Birmingham road, and then on an embankment over

the Marston Green, Easthall, and Sheldon viaducts, crosses a branch of the river Cole, and enters Worcestershire, passing through an excavation, in some places forty-five feet deep. After this, commences another embankment, which crosses the river Cole by a bridge of six arches, and re-enters the county of Warwick.

FIRE-ESCAPE.

To the Editor of the Mechanic and Chemist.

Sir,—Observing in your valuable miscellany, page 220, an account of a fire-escape, I am induced to send you a sketch of an apparatus for the same purpose, which I invented some years ago, but of which I made no use at the time, farther than showing to some friends; should you think it likely to answer the desired end, viz. as an appendage to detached houses, banks, &c., for the rescue of lives and valuable property in cases of fire, I shall be happy to see it get a place in your useful pages.

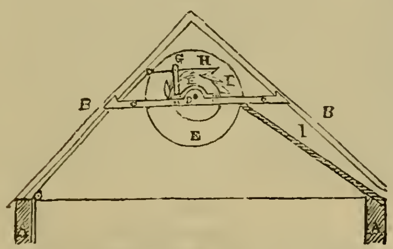
I remain yours, &c.

E. Roxbey,
Basket-maker.

Glasgow.

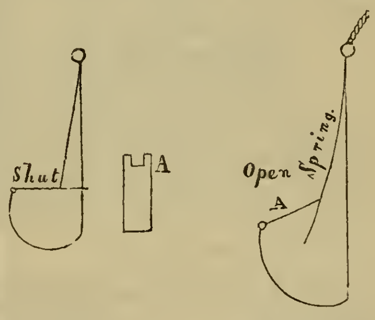
Fig. 1, A A represents a section of the outside walls of a house; B B, the rafters, with C, a tie-beam. On two adjoining tie-

Fig. 1.



beams are fixed blocks, D, forthe axles of a roller, E, to turn in. On each end of this roller are fixed deep ends, E′, and on one end outside of this deep end, is fixed a ratchet-wheel, F. Into the tie-beam, C, is screwed an upright, G, on a pin in which the lever, H, works freely. On one end of this lever is a tooth, which takes into those of the ratchet-wheel, and on the other an eye, to which is affixed a wire, which may be led by pulleys and cranks to any or many parts of the house, in the manner of ordinary bell-wires. I, an inclined plane of any hard smooth wood, terminating in an opening in the outside wall under the eaves of the roof. To the roller, E, is attached the end of a rope or chain ladder, of considerably greater length than the height of the house, which ladder is wound on the roller, and confined in its place by the deep ends F′. To the other end of the ladder is attached a weight of such magnitude as to overcome the friction of the roller with the ladder on it. The operation will now be evident; any of the wires attached to the lever being pulled, the tooth on the other end will be disengaged from the ratchet-wheel, the roller being now free to move, will immediately be carried round by the descent of the weight at the end of the ladder; and thus the ladder will be carried to the ground, where it may be held or otherwise fixed by the spectators. The great length of the ladder is useful, to enable it to be carried to any part of the house, according to where the fire may be, which may be done as follows:—A long line of whipcord being attached to the ladder with a bullet or other weight at its other end, and it being wished to attach the ladder to any particular window, a spectator throws the bullet to the person inside, who, by the cord attached, is enabled to draw the ladder to him, and to attach it to the sill of the window by means of the hooks shown in fig. 2. These consist of

Fig. 2.



two spring hooks, such as are used at our collieries, all rivetted together by an iron bar of the same length as one step of the ladder; these lock on one step of the ladder by means of their springs. To an eye on the shank of each of these hooks is fixed a short rope, whose other ends are attached to eyes in the shank ends of two strong common hooks, which hook on to the window-sill; and by this means the position of the ladder may be varied at pleasure. From the small space occupied by this fire-escape, it may be rendered fire-proof at very little expense, and thus be made to last so long as the external walls remain sound.

DR. TURNBULL.

We are happy to be able to state, from our personal observation a few days ago, that Dr. Turnbull, of Russell Square, has just made a new and important invention, in addition to his other discoveries for the cure of persons labouring under diseases of the ear. It is a syringe or ear-pump, about six inches in length, and four inches in diameter. The handle is hollow, with a screw fitted to its top for the purpose of introducing a small piece of sponge, upon which the ethereal or medicated liquid is dropped. The bottom or lower part consists of a small opening, and the point is like a syringe, made of India-rubber, but exactly fitting the outward orifice of the ear. When the handle of the ear-syringe is drawn out, the ethereal body escapes, fills the cavity of the ear, and at the same time takes off the atmospheric pressure, thereby allowing the seruminous glands to secrete abundance of wax, and securing the healthful exercise of the organs. The rapidity with which the wax is formed is really surprising, as it often begins to fill the ear in five minutes. By means of this most important and ingenious instrument, Dr. Turnbull is enabled to effect cures in cases of deafness, which formerly baffled the skill of the most experienced aurists.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 12, E. W. Brayley, Jun, Esq., on Igneous Geology. Friday, Aug. 14, H. Brown, Esq., on the Preparation and Adaptation of Corneous Substances to the various purposes of Commerce. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Aug. 13, S. C. Horry, Esq., on Juries. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 12th, Lecture and Discussion—Is Teetotalism beneficial to Society? Mr. T. James. At eight o'clock.

QUERIES.

How to make electrotype seals? M. H.

How the reddish composition is made, with which shell-work is fastened, for chimney ornaments? I would beg leave also to hint to your kind correspondents, that I think it would be better if they would give the names of their drugs, &c., in the language of commerce, as well as in the chemical nomenclature; as they may be obtained considerably cheaper by the former than the latter name. W. T.

How are the backs of books made flexible, without being made hollow? C. J. L.

The method of giving that metallic bloom-like appearance on the colour-saucers, whether the finishing process is by baking or not? W. R.

The method of French polishing the carved parts of furniture? I have succeeded in putting it on plain work, as given in the directions in No. 118, Vol. III; but that direction does not answer for ornamental work. An Amateur.

The best method for rendering whalebone white? A Subscriber.

By what process plaster-of-Paris moulds can be rendered fit to take metal casts from; as I have tried it in various metals, such as lead, pewter, and invisible metal, but cannot make it answer at all? I. E. I.

Can any of your readers inform me where I can borrow Logier's work on "The Theory and Practice of Music?" The price of the work being 2*l*., I cannot afford to purchase it. What is the construction of Fuller's freezing machine? Have any of your readers a second-hand oxy-hydrogen microscope for sale?

Querist.

ANSWERS TO QUERIES.

To make Compo-Ornaments for Picture-frames, &c.—Boil seven pounds of the best glue in seven half-pints of water; melt three pounds of white resin in three pints of raw linseed oil. When the ingredients are well boiled, put them into a large vessel and simmer them for half-an-hour; stirring it, and taking care it does not boil over. When this is done, pour the mixture into a large quantity of whiting (previously rolled and sifted very fine), and mix it to the consistence of dough, and it is ready for use.

Birmingham. G. D. Laboszier.

Fly Poison.—Dissolve, by boiling, one drachm of white arsenic in a pint of water. Sweeten with treacle.

TO CORRESPONDENTS.

R. Brownlow.—*We will endeavour to obtain the address he requires, next week.*

A Constant Reader.—*Nitrate of silver; but it will stain almost everything it touches.*

An Amateur. — *The lithographic stones are mounted on wood blocks, and then printed in the same manner as type metal. The price of the plates is regulated by the dimensions. The cost of the stereotype plates for a tract, with four pages, similar to those of the Religious Tract Society, would be about 6s. or 7s.*

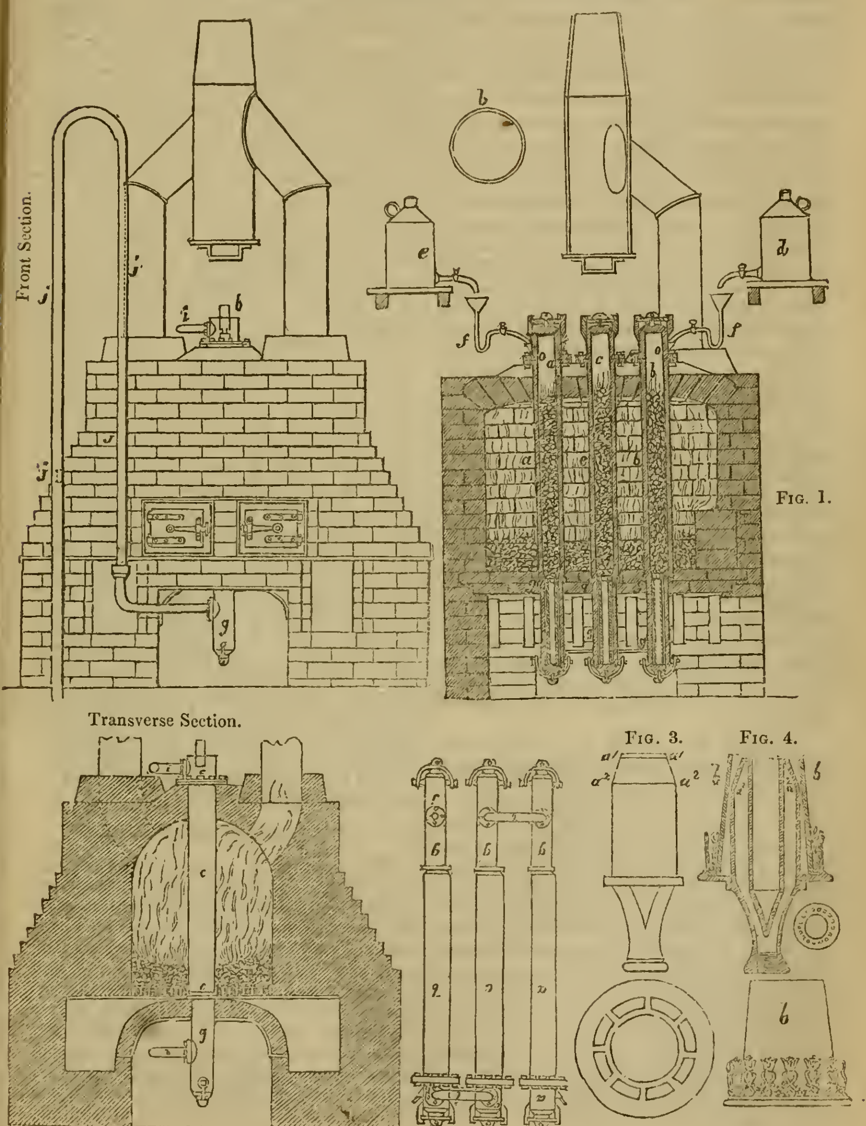
London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street. Strand; and may be had of all Booksellers and Newsmen in Town and Country.

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 105, NEW SERIES. | SATURDAY, AUG. 15, 1840. PRICE ONE PENNY. | No. 226, OLD SERIES.

VAL MARINO'S PATENT GAS-APPARATUS.



Front Section.

Fig. 1.

Transverse Section.

Fig. 3.

Fig. 4.

City Press, 1, Long Lane: Doudney and Scryingour.

VAL MARINO'S PATENT FOR IMPROVEMENTS IN THE MANUFACTURE OF GAS,

And in the Apparatus employed in Consuming Gas.

(*Abstract of Specification.*)

My invention relates, first, to a mode of manufacturing gas for the purpose of light, from coal and other tar and oils, and other fatty matters, together with water; and,

Secondly, my invention relates to an improved arrangement or construction of apparatus or burner for consuming gas for the purposes of light. And, in order to give the best information in my power, I will describe the apparatus used, and the process pursued by me in carrying out my invention. And I would first remark, that it is well known that in converting tar, oils, and other fatty matters into gas for the purposes of light, owing to the excess of carbon it contains, and the consequent want of hydrogen and oxygen in converting such matters into gas for the purpose of light, much of the carbon contained therein cannot be beneficially employed, but is, in fact, lost in the process of decomposition, owing to the want of a sufficient dose of hydrogen and oxygen, in order to convert the whole of the carbon into carburetted hydrogen. And in order to make up for such deficiency of hydrogen and oxygen, requisite for fully saturating the carbon contained in the tar, or in any particular oil or fatty matter, recourse has been had to the decomposition of water, in order to supply such deficiency of hydrogen and oxygen: but, up to the present time, such processes have not, I believe, been successful, owing to the nature of the process pursued, and the apparatus employed.

Now the first part of my invention has for its object a mode of decomposing tar, oils, and other fatty matters, and also water, whereby I am enabled to obtain a more complete combination of the gases evolved; and, consequently, a more beneficial result than heretofore has been accomplished. And such is the nature of the apparatus and process, that the tar, oil, or fatty matter employed, is fully decomposed, by being exposed to highly-heated surfaces of coke or charcoal; and the water is also fully decomposed in suitable vessels or vessel, and acted on by highly-heated coke or charcoal or surfaces. The gas products of the water are, when fully effected, brought into a highly-heated retort, or such like vessel, filled with coke or charcoal, wherein the decomposing of the tar, oils, or fatty matters, is going on, and by this process, such is the chemical action and re-action of the gases, that the carbon contained in the tar, oils, or fatty matters used, becomes fully saturated; and thus may be obtained the whole, or very nearly the whole of the carbon in the state of carburetted hydrogen gas. It is well known that different tars, oils, and other fatty matters, evolve, when decomposed, different relative quantities of carbon, hydrogen, and oxygen, consequently require the decomposition of more or less water to make up the deficiency, by supplying hydrogen and oxygen sufficient to saturate the excess of carbon, in order, under the most favourable circumstances, to produce carburetted hydrogen gas for the purposes of light. Care must, therefore, be observed, in making carburetted hydrogen gas from tar, or from particular oils, or from other fatty matters, to ascertain how much water the same will require to have decomposed. But as an analysis of all, or almost all of such matters, is to be found in most modern chemical works; it will not be necessary to enter more at large into this subject, farther than to remark, that one atom of carburetted hydrogen consists of two atoms of carbon, and two atoms of hydrogen. One atom of oxide of carbon consists of two atoms of carbon and one atom of oxygen; and as water, when decomposed, produces twelve per cent. of hydrogen, and the rest oxygen, it follows that, having ascertained the quantity of carbon, hydrogen, and oxygen, contained in the particular matter about to be employed in the manufacture of gas, the quantity of water required to be decomposed to make up the deficiency of hydrogen and oxygen, will be immediately known. And I would farther remark, that, in order to fully and most beneficially perform my invention, it is of importance that the retorts or apparatus employed, should be kept at a uniform heat, that is, at a bright white-red heat.

Description of the Drawing.

The drawing, fig. 1, represents the section of three vertical retorts, suitably arranged for performing my invention; and the furnace is suitably constructed for conveniently heating and maintaining the same at a uniform temperature; *a*, *b*, and *c*, being the three retorts, one for decomposing the tar or oil, or other fatty matter employed, another for decomposing the water, and a third for continuing the products of the water. It is not, however, material, which of the retorts is used for the separate duties, they being all similar.

In the arrangement shown, *a* is the retort in which the water is decomposed; *b*, the retort in which the tar or oil, or other fatty matter is decomposed; and *c* is the retort into which the gases evolved in the retort, *a*, enter, and are farther decomposed; the object being fully to decompose the water before the products thereof come into the retort, *b*, to combine with the products of the other retort; *d* is a vessel containing tar or oil, or other fatty matter; and *e* is a vessel containing water; *f f* are two syphon pipes, which enter into the upper parts of the retorts, *a* and *b*; and there are cocks on the vessels, *d* and *e*, to regulate the supply. The nature of the retorts, which are of cast iron, is clearly shown in the drawing, each retort having a projecting or descending tube, *g*, connected at the lower end thereof; within which the gratings, which are similar to fire-bars, can be raised and lowered, and the coke or charcoal in the retorts rests on these gratings, which allow of the passage of any small ashes or dust of the coke. The arrows indicate the direction of the gases, in and from the respective retorts; and the pipes, *h i*, connect the retorts, *a* and *c*, and *b* and *c*, as is clearly shown in the drawing; and, in using this apparatus, the three retorts are filled from above, with coke or charcoal, and then the ends of the retorts are to be closed, and all things arranged, as shown in the drawing. I would here remark, that although I prefer that the retort, *c*, should contain charcoal or coke, this is not absolutely necessary; and it should be understood, that I prefer the use of coke in consequence of its cheapness, and the retorts are charged with fresh coke every twenty-four hours; and I have found that I am thereby enabled to retain the temperature required more readily, the retorts being at a good red-white heat; the tar or oil, or fatty matter, and also the water, is to be permitted to flow, observing that the water is allowed to drop, in proportion to the requirement of the other matter employed; and as it is difficult to arrange apparatus to perform this operation with nicety, and as the syphon tubes might become more or less stopped in working, the simplest and the best practical means I am acquainted with for regulating the supply of water to the requirements of the matter employed is, to have a lighted gas-burner near the retort, and within sight of the workman; by this means he will, from time to time, be enabled to observe whether the result of his working is according to the desired object; and if he observes that the flame becomes more coloured than is proper, it will indicate that too little water is being suppl ed; and by this simple means, the workman having once set it right, the working will go on correctly, unless some impediment is offered to the supply of the matter employed or the water: *j* is the gas-pipe leading to the gasometer; for it should be understood, that carburetted hydrogen gas thus manufactured, will not require purifying, which is an important advantage appertaining to this mode of working. It should be stated, that the matter I generally employ, and, according to the cost of the various matters above mentioned, will, I believe, be most advantageous, is coal-tar; and, I would farther observe, that, although I prefer the arrangement of apparatus herein described, for the purpose of decomposing the matters and water employed, I do not confine myself thereto, provided the mode and process of working be retained as herein described.

I will now proceed to describe the second part of my invention.

Fig. 3 shows an external view of a gas-burner or apparatus for consuming gas, constructed according to this part of my invention; and, .

Fig. 4 is a section thereof. On examining the drawing, it will be seen, that the outer surface of the upper part of the burner, *a*, is coned, as indicated from a^1 to a^2; in other respects it is of the ordinary construction; and *b* is an outer cone, which carries the gallery for the glass chimney, consequently the supply of air for the external of the flame will pass between the burner, *a*, and the cone, *b*; and owing to the upper part of the burner being in the form of a cone, the air will rush up in a direction to pass through the flame, and, by this means, effect a more perfect combustion of gas supplied to such arrangement of apparatus.

MORRICE'S IMPROVED METHOD OF MANUFACTURING BOOTS AND SHOES.

(Abstract of Specification.)

THE invention consists in a mode of manufacturing boots and shoes, whereby the labour of sewing is dispensed with, and they are rendered more durable, and the feet are kept more free from damp and wet, than with shoes or boots of the ordinary description. In manufacturing boots or shoes, I take the under sole of the required size and form, and place it on the last, over which is brought the vamp or upper leather, which is pierced with a series of holes at the lower part, as shown

in the drawing; into these holes is put a thin cord, by the lacing of which, the upper leather is drawn tightly over the last. It will be seen that the vamp has also another series of holes, the purpose of which will presently be explained. Before drawing the cords of the vamp together, I place between it and the inner sole, either a plate of metal, or cork, or dissolved India-rubber, or any other suitable material which will prevent the wet from affecting the feet. When the upper leather is drawn together, I, with an ordinary shoemaker's hammer, press down the cord, which would otherwise present an uneven surface; when this is completed, I apply it to the outer sole, fig. 2; this sole is screwed on the boot or shoe by means of screws, which would fit into the holes made through the vamp; the heel is afterwards added in the ordinary manner of manufacturing boots and shoes. It will be seen by the drawing, that the screws here shown are somewhat different from the ordinary wooden screws, inasmuch as the heads are formed differently, being longer, and the cut in them is also deeper; the object of this is, that as the leather of the sole wears away, they may be the more easily removed.

Fig. 1 represents a view of the under-side of a boot or shoe, showing the manner of fixing the vamp or upper leather to the sole; the same letters of reference denote

FIG. 2.

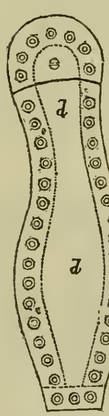
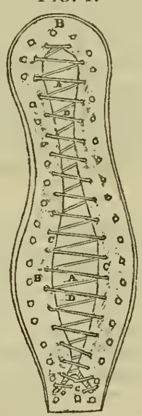
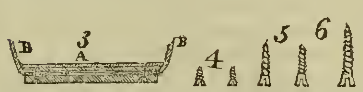


FIG. 1.





similar parts in each of the figures wherever they occur. A is the under sole of the boot or shoe; B is the vamp or upper leather; C, the holes through which the cord passes, to draw the upper leather together; D, the lacing-cord.

Fig. 2 shows the exterior sole before it is screwed on to the other part of the boot or shoe; *d* and *e* represent the holes through which the screws pass, to fix the soles together.

Fig. 3 represents a section of the boot, showing the mode in which they are fixed together.

Fig. 4 shows the screws for attaching the soles together; and,

Figs. 5 and 6, the screws for fixing on the heels.

It will be evident that this invention may be also applied to those descriptions of coverings for the legs which have soles attached to them; the mode of its application being the same as above described, it will not be necessary to repeat the description of it.

Enrolled April 17th, 1840.

ON THE CONSTRUCTION OF SUNDIALS.

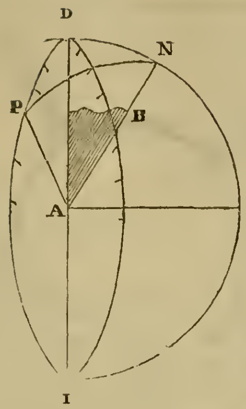
(Continued from page 118.)

THE next in order is the north dial; that is, a dial whose face points to the north. This dial, however, can only be of use before six o'clock in the morning and after six in the evening; and, similarly, a dial whose face points to the south, can only point out the hours between six in the morning and six in the evening. However, I have in both cases given the angles which the stile would make, if it were possible, with the line from which the other angles are measured. This I have done, in order that persons wishing to complete the whole face may be able to do so; though, of course, these extra lines will be of no use, farther than giving a more finished appearance to the dial.

Let, as before, D I be the dial plate, the line, D A, being vertical; whence at midnight, the shadow should fall at A D (A B being the stile), whence the angle, D A P, will be the angle made by the hour-line, with the vertical line, D A. Then N O will be the latitude of the place, and D N P, the hour angle; whence, for same reason as before,

$$\text{Sin. } DN = \text{tan. } PD \, . \, \text{cos. } DNF;$$
$$\text{Or, tan. } PD = \text{sin. } DN \, . \, \text{tan. } DNP.$$

FIG. 1.



But D N is the complement of N O; that is the complement of the latitude; then if P D be represented by H, D N P by h, and O N by λ, we have

$$\text{Tan. H} = \cos. \lambda \,.\, \tan. h.$$

Whence, making h successively equal to 15^0, 30^0, &c., we have for Greenwich,

(1.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 15^0 = \tan. 9^0\ 28'$

(2.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 30^0 = \tan. 19^0\ 46'$

(3.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 45^0 = \tan. 31^0\ 55'$

(4.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 60^0 = \tan. 47^0\ 10'$

(5.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 75^0 = \tan. 66^0\ 43'$

(6.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 90^0 = \tan. 90^0$

(7.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 105^0 = \tan. 113^0\ 17'$

(8.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 120^0 = \tan. 132^0\ 50'$

(9.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 135^0 = \tan. 148^0\ 5'$

(10.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 150^0 = \tan. 160^0\ 14'$

(11.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 165^0 = \tan. 170^0\ 32'$

(12.) $\text{Tan. H} = \cos. 51^0\ 29' \,.\, \tan. 180^0 = \tan. 180^0$

Whence, for

A.M.	P.M.		°	′
Midnight or 12		the angle, D A P, must be	0	0
1 —	11	....	9	28
2 —	10	....	19	46
3 —	9	....	31	55
4 —	8	....	47	10
5 —	7	....	66	43
6 —	6	....	90	0
7 —	5	....	113	17
8 —	4	....	132	50
9 —	3	....	148	5
10 —	2	....	160	14
11 —	1	....	170	32
12 —	noon	....	180	0

We are compelled, through want of space, to defer till our next the remainder of this paper.

ON ELECTRICITY.

NO. IV.

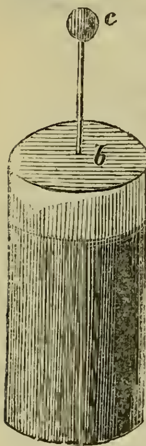
(Concluded from p. 100.)

WE have hitherto only spoken of the phenomena, and those experiments which can be illustrated by means of the electrical machine alone, by which it will be understood that we mean by small supplies of electricity; but we must now turn for a moment to the consideration of a law, without which none of the powerful effects of this fluid could be manifested; without which we must be content only to surmise what might be done by means of accumulated electricity. We are, however, not left in the dark upon this subject; the law which reveals it, and which we are now to consider, is termed the law of induction. When a body, as the prime conductor of the machine, for instance, is charged with electricity, and insulated so as to prevent the escape of that electricity, this fluid will remain perfectly quiescent, if at a distance from all other bodies; but if a conducting body be brought into contact with it, or within striking distance, the whole of its electricity will be carried away by it, accompanied with a spark; should, however, this body not be brought sufficiently near to carry away the electricity, with a spark (or by transference) it would still not remain perfectly quiescent, but induce in such body, and on the side nearest the conductor, a state of electricity opposite to its own; and on the side farthest from it, a state of electricity similar to its own.

For instance, if the prime conductor were charged with positive electricity, it would induce in an insulated metallic cylinder in its vicinity, and on the side nearest it, negative electricity, and positive on the side farthest from it. If, however, the prime conductor were charged with negative electricity, the electrical states into which the cylinder would be

thrown, would be exactly the reverse of the above.

Advantage is taken of the above law for the construction of Leyden vials, by which we are enabled to accumulate almost any amount of electricity. The annexed figure is a representation; but before we proceed, it may be as well to observe, that this law will act just as effectually through an electric or a plate of glass, as if no such substance had intervened.



a is a glass bottle,* open at the top, coated on the inside and outside, about three parts of the way up, with tinfoil. It is furnished with the lid, *b*, of baked mahogany, through the middle of which passes a metallic rod, communicating with the interior coating, and furnished, at the upper extremity, with a knob, *c*. The method of changing it is as follows:—Take the bottle in the hand, and bring the knob to the prime conductor of the machine when in action. The electric fluid passes along it to the inner coating, which is thus rendered positive; at the same time, the electricity of the outer coating is carried away by the hand, the law of induction rendering it negative. When nearly coated, if by means of some conducting body, as a pair of discharging rods, a communication is made between the outer and inner coatings, or, in other words, between the positive and negative states. The electricity will rush from the former towards the latter, accompanied with a vivid flash and an explosion, or what is more generally known by the name of the electric shock, and the equilibrium will be at once restored.

The discharging rods of which we just now made mention, consist of a semicircular rod of brass, with a knob of the same metal at each extremity, and a glass handle attached. The annexed engraving is a representation.

When one knob is brought into contact with the negative coating of a Leyden jar, and the other to the knob, which communicates with the positive coating, the discharge is instantaneously effected, and the glass handle prevents the operator suffering any inconvenience.

During an electric explosion, a considerable degree of heat is evolved, which is sufficient even in a small Leyden vial to ignite most inflammable substances. If a little wool, sprinkled with powdered resin, be loosely tied to one of the knobs of the discharging rods, it will, when the vial is discharged, be instantaneously ignited. Turpentine, ether, spirits of wine, may also be included among the list.

The number of experiments similar to the above, or varied in their character, which may be performed by means of a single Leyden jar, are numerous; but an enumeration of them would exceed the limits of these brief papers; and, in con-
treatise in two parts on electricity, pub-
cluding them, we would recommend to
those who wish to know more of the subject,
lished under the superintendence of the Society for the Diffusion of Useful Knowledge. It is one which enters fully into the subject, and may be had of Baldwin and Co., Paternoster Row.

LIFE ASSURANCE.

NO. VII.

SOCIETIES IN LONDON.

THE societies of London are sufficiently numerous to present our readers with a fair outline of all the systems that are abroad for Life Assurance. Without dilating on the subject, it may briefly be observed, that the following lists of offices have been derived from the printed particulars put forth by themselves; and as nothing particular occurs in the first list worthy of remark, we would only notice

* I would advise all to whom economy is an object, to purchase an uncoated Leyden jar, which may be had at Ward's, Bishopsgate Street, and coat it themselves. With a little practice they will soon become expert at it, and it will be found to be a considerable saving. This is the plan the writer adopted, and he found his jars to answer in every respect as well as those ready purchased.

to the reader, that they are here placed with the dates of their institution—the first class wholly consisting of societies which devote none of their profits to assurers, but to the shareholders only.

Date.	Name of Society.	Whether Fire or Life.
1722	Royal Exchange........	Both
1796	West Middlesex.........	Both
1797	Pelican	Both
1803	Globe	Both
1805	Albion	Both
1826	Promoter..............	Life
1834	Argus	Life
1834	London and York	Life
1836	Standard of England....	Life
1837	Britannia	Life
1838	Benevolent	Both

Those which come secondly under our notice, are the mixed Proprietary Societies, which have made promises of a division of profits in part, with such of their assurers as have paid the premiums stated in their profit scale. Generally, the promise is two-thirds of profits, after the shareholders have taken their portion, and the interest of a borrowed capital, with other contingent expenses, have been paid!

Date.	Name of Society.	Periods of Division of Profits.
1710	Sun	7 years
1714	Union	7 ditto
1721	London Assurance	Annually
1792	Westminster	Annually
1797	Palladium	7 years
1805	Caledonian	7 ditto
1806	Provident............	7 ditto
1806	Hand in Hand	6 ditto
1806	Rock	7 ditto
1807	Eagle	7 ditto
1807	Hope	7 ditto
1807	West of England	5 ditto
1808	Norwich Union......	7 ditto
1808	Atlas	7 ditto
1809	North British	7 ditto
1819	European	7 ditto
1820	British Commercial ..	7 ditto
1820	Imperial	10 ditto
1821	Guardian............	7 ditto
1823	Economic	5 ditto
1823	Law Life............	7 ditto
1824	Crown	7 ditto
1824	Alliance	5 ditto
1824	Scottish Union	7 ditto
1824	Asylum	5 ditto
1825	University	5 ditto
1825	Clerical, &c.	5 ditto

Date.	Name of Society.	Periods of Division of Profits.
1830	National	Annually
1834	Universal	Annually
1835	Protector	5 years
1836	Minerva	5 ditto
1836	Licensed Victuallers' ..	5 ditto
1836	Legal and General	7 ditto
1836	Independent	7 ditto
1837	National Loan Fund ..	Annually
1837	Protestant Dissenters'..	—
1837	Naval and Military ..	7 years
1838	Victoria	7 ditto
1838	National Endowment..	—
1838	United Kingdom......	7 years
1839	Mercantile Travellers'	5 ditto
1839	Alfred	5 ditto
1839	Freemasons'	After 1843
1839	Westminster Mutual ..	Annually
1840	Australasian & Colonial	—
1840	Active	—
1840	Ark	—
1840	Church of England....	—
1840	Farmers and General..	—
1840	New Equitable	—
1840	Reliance	—
1840	Scottish Law Life	—

The foregoing constitutes the chief number of offices open for assuring lives in London, with but very little difference in their mode of transacting business, or treating their assurers; their grand aim being to compete with each other in the cheapness of their rates, and invite the unwary public by every flattering announcement, both in their prospectuses and by advertisements, that can possibly be set forth—each contending its *own* superiority.

Now from our brief table it is worthy of remark, that a vast difference is observable in the periods of divisions of profits with a few, compared with the rest. There is but a slight disparity, if any, in the prices named by each for assuring 100*l.*; but yet few have afforded the public the advantage of an annual division of profits, compared with those who have fixed their periods from five to seven years and upwards. Although, strictly speaking, this is not to be the criterion for selecting from the above offices, inasmuch as the expectation of a person assuring in any of them, cannot be supposed to be great; well knowing, as he ought, if he does not, before entering them, that their *profit-takers* are their proprietors, and not their assurers.

For an example, what can the reasonable expectation of a person be, who assures in "The National," when he sees

their direct aim is to crush the idea in the minds of the public, that a mutual society is of the best advantage to assure in? And, then, by way of taking the profits, to distribute them chiefly among their proprietors, assert with modesty, that they give their assurers "freedom from all responsibility," and numerous other privileges. And what, may we ask, do those privileges consist of? Why this—that "two-thirds of one-fifth" of their profits should be divided annually, being, in reality, not *one-seventh part* of their gains; yet, for this promise, an assurer is taxed upon a higher rate of premium, before he can be allowed to enjoy so important an advantage. We look at the equity of the thing. But, then, upon this plan of dividing but so small a share of profits, that they are not worthy the name, are others established, such as "The Minerva," "The Licensed Victual'ers'," "The National Loan Fund," "The Victoria," and several others of later date; and, we hope, it will be seen, that, rather than have placed them with the older mixed Proprietary Companies, whose mode of division is of a different kind, we ought, in justice to the public, to have set them on one side.

(*To be continued.*)

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 19, E. W. Brayley, Jun., Esq., on Igneous Geology. Friday, Aug. 21, H. Brown, Esq., on the Preparation and Adaptation of Corneous Substances to the various purposes of Commerce. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Aug. 20, S. C. Horry, Esq., on Juries. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 19th, Mr. E. W. Plews, on Galvanism. At eight o'clock.

QUERIES.

The process of preparing horse-hair, such as I have seen in the sieve-makers' shops in London; viz. how they get it so straight, and with the roots all one way? Also, the method of curling horse-hair for stuffing sofas, &c.? A. B. M.

How to make a paste or composition which, when laid on paper and afterwards dried, will, on applying slight moisture (as of the tongue) render the paper perfectly adhesive? Q—Y.

The best and simplest method of making an electrotype apparatus? Also, the easiest way of detaching the precipitated metal from the original plate? Q—Y.

Having a large quantity of acid porter, I am desirous of converting it into something saleable, if possible—say vinegar; but being unacquainted with the process of its manufacture, I wish to know how to proceed, and how to take away the colour. Perhaps some of your correspondents could favour me with the most approved method of manufacturing this article from malt, sugar, &c., and the strength generally made by saccharometer to produce the numbers 18, 20, 22, and 24, as sold by the trade. H. SHERMAN.

The best plan for making a gymnastic pole, and the manner the ropes are fixed to it? Also, in what manner the ropes are fixed, which the parties leap over in running round? FRANK.

The best and easiest method of gilding picture-frames? A. G.

TO CORRESPONDENTS.

P. Truman.—*We shall avail ourselves of the papers he has sent us as early as possible.*

A. G.—*Try a strong infusion of tobacco.*

S. M. C. *asks*, "*Is it possible to determine* accurately *the precise moment when the sun reaches its meridian, on a wet or cloudy day, and the sun consequently invisible?*" *The exact time at any place of* known latitude, *may be ascertained by an accurate chronometer; but such computation must, of course, be subject to the error of the machine. If the latitude be not known, there are no means of finding the meridian on a cloudy day.*

G. B. *next week.*

J. Banks *will find his query answered in another column of the present Number.*

J. M. K.—*Shoemakers' heel-balls are composed of rosin, bees' wax, linseed oil, and lamp-black; the proper proportions must be found by experiment. Ullathorn's are the best; but the exact process he employs is not known, as none have been able to equal them. His other queries shall be attended to.*

J. S.—*Early youth is unquestionably the most favourable period for the commencement of study; but remember* "you are never too old to learn." *Many men, who have risen to great eminence, commenced their chief studies so late in life as thirty, forty, and even a still more advanced age. Socrates, Plutarch, Cato, and many others, commenced new studies in their old age; L. Monaldesco wrote a book at the age of* 115, *and La Casa said he* thought *he should write sonnets twenty or thirty years after his death.*

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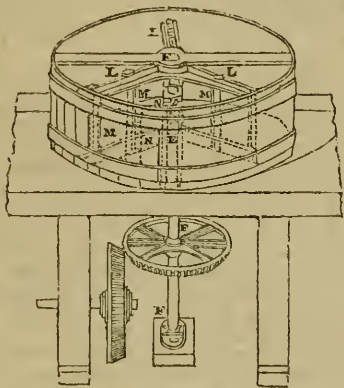
THE

MECHANIC AND CHEMIST.

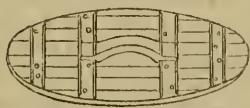
A MAGAZINE OF THE ARTS AND SCIENCES.

No. 106, NEW SERIES. | SATURDAY, AUG. 22, 1840. PRICE ONE PENNY. | No. 227, OLD SERIES.

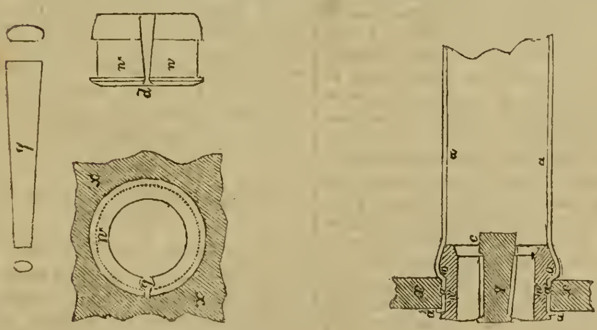
RICHARDSON'S PATENT PROCESS FOR THE PREPARATION OF SULPHATE OF LEAD.



COVER OR LID.



WAHL'S PATENT STEAM-ENGINE BOILER.



City Press, 1, Long Lane: Doudney and Scrymgour.

RICHARDSON'S PATENT PROCESS FOR THE PREPARATION OF SULPHATE OF LEAD,

Applicable to the purposes for which Carbonate of Lead is chiefly employed.

(Abstract of Specification.)

I USE protoxide of lead, as it usually occurs in commerce, and prefer what is known as flake litharge, which is put into the tub hereinafter described, where it is mixed with a quantity of strong acetic acid, in the proportion, and of the strength, after mentioned, and a quantity of pure water, sufficient to render the whole moist; the mixture thereof is effected by the agitation hereinafter explained, which is continued sufficiently long to enable the acetic acid to act upon the protoxide of lead, and to convert a portion of it into an acetate of lead. I use acetic acid, of the specific gravity 1.046, or thereabouts, in the proportion of one part to fifty, six parts of protoxide of lead, and I operate upon one ton of litharge—this proportion is the most economical; but a larger proportion of acetic acid may be used. The agitation is continued; and when a portion of the protoxide of lead is converted into acetate of lead, I begin to pour into the tub, through a leaden or other convenient pipe, sulphuric acid, of the specific gravity 1.5975, or thereabouts, at the rate of about one pound per minute, until a quantity of sulphuric acid has been added sufficient to convert all the protoxide of lead into a sulphate of lead. This quantity must be in the proportion of twenty parts absolute sulphuric acid to 112 parts of protoxide of lead; but the proportion of sulphuric acid may be increased to forty parts. The agitation is continued until the whole of the protoxide of lead has combined with the sulphuric acid added, when the sulphate of lead thus formed is removed to convenient troughs, where it is washed free from all foreign substances. After the washing is finished, it is ground in water, and then dried in stoves similar to those already in use in manufactories of white lead; this sulphate of lead thus made will possess a body, and is applicable to some of the purposes for which carbonate of lead is now applied—to wit, painting, glazing, pottery ware, &c. The apparatus which I recommend to be used for the agitation, hereinbefore described, is as follows, viz.:—

Description of the Drawing.

A circular wooden tub or vessel, as shown in the drawing (see front page), of the depth of about two or three feet, and about six or seven feet in diameter, completely lined with sheet-lead, and covered by a lid. This vessel should be raised a convenient height from the floor of the apartment in which it may be placed, so as to allow the machinery for agitating the materials, sufficient working space underneath. In the centre of the bottom of the vessel should be fixed, pointing upwards, and perfectly water-tight, where it joins the leaden lining, a leaden tube or boss, E E, about eighteen inches high, and of a diameter sufficient to allow an upright shaft, F, to pass through. This upright shaft, F, is fixed in the ground, or in the floor of the apartment, in a footstep, so as to be easily moveable, and passes up through the bottom of the wooden tub through the tub or boss, E, nearly to the lid of the tub, into a bar of wood fixed across the tub, to steady the motion. Near to the top of the shaft, F, are fixed three horizontal arms of iron, L L, at equal distances from each other, reaching to within about two inches of the sides of the tub; into each of these are arms inserted, and fixed by means of screws, two iron rods, M M, reaching to within about an eighth of an inch of the bottom of the vessel. To the ends of the rods are fixed thin iron plates, N N, about two inches broad, and of a length to reach from one-eighth of an inch to the side of the tub, to within one-eighth of an inch of the leaden boss, and sloping forwards at an angle of about 25° or 30° to the bottom of the tub. The whole of the machinery inside the tube must be covered with sheet-lead, to protect the same effectually from the action of the acids. The upright shaft, F, is made to revolve by a bevel cog-wheel fixed near to its lower end, working into another bevel cog-wheel attached to a shaft, worked by steam or any other power, by which means the machinery is made to revolve inside the tub, and agitate the materials in a very perfect manner.

Enrolled June 9th, 1840.

WAHL'S PATENT STEAM-ENGINE BOILER.

(Abstract of Specification.)

MY improvements consist in a mode of fixing the tubes of that description of boiler called tubular boilers, which are used for locomotive engines and for other purposes; whereby I am enabled to obtain the expansion or contraction of the tubes required, and in such manner as more completely to prevent their being displaced; and this is effected by placing at

the ends of the tubes what may be called split rings, which rings will be of various forms and sizes, according to the dimensions of the tubes to which they are applied.

According to this invention, the ring which enters the end of the tube is slit; and when within the tube, the ring is expanded by a wedge or key, as hereafter explained; and it is preferred that the ring should be grooved on the external surface. In case of its being required to take off one of the rings, the wedge or key is withdrawn, and the collar becomes free; it may be then withdrawn without any difficulty.

Description of the Drawing.

x represents a section of the boiler-plate; a, one of the tubes which fits in the opening formed in the plate; and it will be seen that the tube is bent at the end, as shown at a^1; w is a split ring, which is placed in the inner part of the tube, a, in order to close or fix it in the plate, x. The nature of the ring, and the opening to receive the wedge, will readily be understood by examining the drawing.

The wedge, g, fits into the inner part or slit, c, and closes it to the part, d; and when well pushed in by a rod or other means, it is cut off and rivetted at d; o represents the groove or recess around the ring, w. I would remark, that although I have shown the ring, w, to receive the wedge or key from the inside of the tube, it will be evident that it may be suitably formed by reversing the opening of the slit in the ring, and thus allow of the wedge being forced inwards; and in such cases it does not require to be rivetted.

From the foregoing description it will be seen, that the tube, a, will be caused to lap over the edges of the opening in the boiler-plate, and thus more completely prevent the possibility of movement or loosening of the tube, a; and the same will be rendered more water and steam-tight at its points of junction with the boiler-plate through which it passes; and I would have it understood that the ring, w, should be of the shape and figure shown. The same may be slightly varied, without departing from my invention, so long as the same is suitably arranged for receiving wedges to expand them outwards, and thus to make the diameter of the tube within the boiler somewhat larger than the hole through which it is passed. In the mode described, I have shown split rings with wedges; but I do not confine myself thereto, as it will be evident that rings, which are not split by the insertion of a wedge or mandril, may be used to produce the same effect.

Enrolled May 9th, 1840.

EDUCATION OF THE WORKING CLASSES.

To the Editor of the Mechanic and Chemist.

Sir,—The extent and position of the working class of this country at the present moment, is highly interesting to every person who admits the truism, that "labour is the source of wealth;" and that it should be the duty of a well-ordered government to exercise a kindly guardianship over that class of the community, whose welfare more or less affects the stability of the empire to which it belongs.

A class living by labour under ordinary circumstances, must be affected by the natural existence of *external* and *internal* difficulties, which must always, to a greater or less extent, retard the progress of intellectual improvement, which, next to the sway and operation of cheap and wholesome law, is absolutely identified with its prosperity and social elevation. The external difficulties result from the necessity of toiling during two-thirds of what may be termed the active day (in contradistinction to the passive, or what is appropriated to rest and sleep), for at best a hard-earned subsistence, which has to be doled out with care and economy, to meet the returning wants of seven days; and the fatigue of nature which, in most cases, accompanying the cessation from labour, leaves the mechanic at the close of the day, generally unfitted for sedentary employment or mental recreation. From these existing and outward circumstances are created the internal difficulties, arising from the neglect of individual education in youth, and the prevailing want of a taste for moral improvement, which generally accompanies the habits and feelings when wedded to ignorance and toil.

Thus situated by the force of circumstances, and with a large share of prejudice flung into the scale by the other constituent parts of society, the productive mass have been allowed to struggle on for years past, with all the custom-bound feelings which their restricted situation was peculiarly fitted to generate and cherish.

Emerging as from a thick gloom, the labouring population as a body are now, however, intuitively awakening from their lethargy. Thanks to the master spirits of

their order, the elevation of the working class has been held up as practicable, and, however daring to others it may appear, the philanthropist beholds in all the stirring principles of the day, which are emanating from the sons of labour, an honest desire to emancipate themselves from the trammels of ignorance; and, by uniting for mutual benefit and moral improvement, the abdication of the monster of intemperance, the destruction of the brand of depravity and degradation, they now claim for themselves a proper and rational footing in society, as respectable, useful, and enfranchised men.

What are all the political struggles of the day? What is the important scheme of erecting a *Trades' Hall* in the centre of London by 1*l*. shares among the operatives of the metropolis? What are the institutions of asylums for their aged and infirm brethren when past work, which are now promoting in almost every trade, but so many pleasing indications that the mind is expanding, the heart enlarging, and the intellectual condition of the working men of the country promising a glorious and speedy exaltation?

In London, as the capital of the world, the master spirit of mental enterprise has very aptly reared its throne; there the *Trades' Hall*, if successfully carried out, will concentrate the now divided mass, and bring it into closer sympathy and unity of action; instruct the children of mechanics in useful knowledge, that the next generation of artisans may come forth armed with all the intelligence and determination of educated men, and cement the bonds of society with a more equalized position mutually granted by all, as the stamina of the national wealth and honour. These principles, thus unanimously carried out by the great working population, will, consequently, invest with a moral dignity all the various institutions for their benefit, which are now carrying on: among these will rank pre-eminently *Trades' Halls*, for their welfare and instruction in the active years of their life; and *Provident Asylums* (such as the bookbinders of London are now anxious to erect) to shelter them in the closing days of life, to invest their path with comfort and peace, and screen them from the iron tyranny of pauper laws.

I am, Sir, yours respectfully,

WM. FARREN.

Trades' Hall Office, 16, Old Bailey.

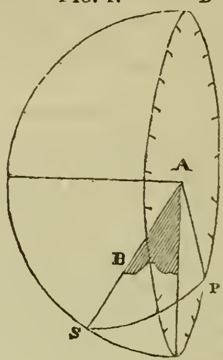
ON THE CONSTRUCTION OF SUNDIALS.

(Concluded from page 125.)

WE next proceed to the south dial; but as this is so nearly similar to the one we have just described, we shall merely point out the difference.

As the sun has attained its greatest elevation at twelve o'clock, noon, the shadow of the stile must be in the line, A I.

FIG. 1.



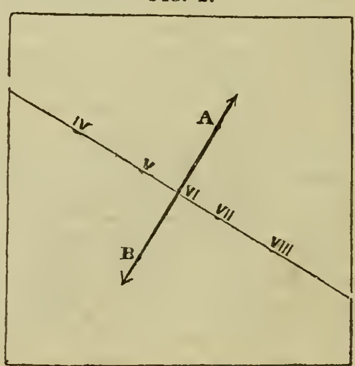
Whereas in the north dial it was in the line, A D; the line, S I, which is equal to D N, is also equal to the complement of the latitude. Whence, as before,

$$\text{Sin. } S I = \text{tan. } I P \text{ cos. } I S P;$$
$$\text{Or, tan. } I P = \text{sin. } S I \text{ . tan. } I S P;$$
$$\text{Or, tan. } H = \text{cos. } \lambda \text{ . tan. } h;$$

from which the same angles as before will be found.

In the construction of dials to face either the east or west, we only require a small rod, which can be suspended parallel to

FIG. 2.

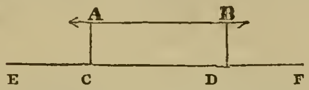


the plane of the dial, but making an angle

with the horizon equal the latitude of the place.

Thus let A B be a rod suspended at a short distance from the plane by two pins at A and B. Thus let fig. 3 be a section of the dial drawn through the stile perpen-

FIG. 3.

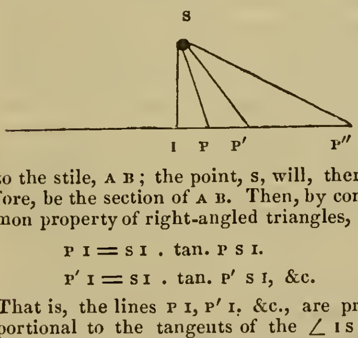


dicular to the plane of the dial, then A′ B′ will be the stile, and A′ C, B′ D its supporters; E F being a section of the plane of the dial.

As the sun revolves round the heavens, it is evident that it must describe a path which, towards the east and west, will appear a straight line; the line, therefore, upon which the hours are marked, must be a line perpendicular to the right line joining C D, the feet of the perpendiculars from A B, the point directly under the stile, denoting six o'clock, either morning or evening, according as the dial is east or west.

Let fig. 4 be a section of the dial perpendicular

FIG. 4.



to the stile, A B; the point, S, will, therefore, be the section of A B. Then, by common property of right-angled triangles,

$$\text{P I} = \text{S I} \cdot \tan. \text{P S I}.$$

$$\text{P}' \text{I} = \text{S I} \cdot \tan. \text{P}' \text{S I}, \&c.$$

That is, the lines P I, P′ I, &c., are proportional to the tangents of the $\angle$ I S P, I S P′, &c. But the angles, I S P, I S P′, are the angles described by the sun in a certain time; that is, if they be made successively equal to 15°, 30°, &c., by producing these lines, to meet the line I P′; that is, the dial plate, we have the distance passed over in each hour.

If we call S I = 1, we have

		H.	H.
P I = tan. 15° = 0.268; i.e. for		5 or	7
P′ I = tan. 30° = 0.577	......	4	8
P″ I = tan. 45° = 1.000	......	3	9
P‴ I = tan. 60° = 1.732	......	2	10
P⁗ I = tan. 75° = 3.702	......	1	11

but tan. 90° = ∞; that is, the line would never meet the dial plate, and, therefore, this dial can only show the time near either the rising or setting of the sun.

J. A. S.

LIFE ASSURANCE.

NO. VII.

(Concluded from p. 128.)

LET us, for a moment, glance at one of these societies in the division of their profits. Let us suppose (as will be more just than exposing their error, by naming any one in particular) we ascertain that some one society has, by ways and means, accumulated 14,500*l.* in the shape of profit; this can be only done when their capital is properly invested; a thing, kind reader, you dare not ask some of them, or they would have to tell a direct lie. Suppose, then, this sum is put down at the year's end as *their* profit in total; see ye, to whom none of these secrets have been told before, how wisely will be their distribution among their members. We should not have said members—assurers.

Interest upon 50,000*l.* borrowed money, at five per cent..	£ 2500
House rent and expense (considered a moderate sum)	2500
Advertisements (this is the average estimate)................	2000
Paid directors for one year's attendance....................	1500
Salary of officers (perhaps)......	1500
Commissions	3000
Balance remaining	1500
	£ 14,500

Of the amount remaining, *two-thirds* has been stipulated as the profit for the assurers, the other portion to go to the share-holders, who, it will be seen, have already drawn 2500*l.* as interest upon the capital lent. Of the commissions which may at first sight startle the reader, we have more to say anon. Let us only, at present, beg the forbearance of the public for having led them to such length, with observations on a system of Life Assurance, which falls so short of *equity*, *philanthropy*, or even *common honesty;* and let us entreat them to make a just discrimination between those we have described, and the long-established and respectable offices which mingle with others in the foregoing list, where the same mode of deception is seldom, if ever resorted to. We are aware that, to examine their various prospectus will yield no clue to detection, but the exercise of a common

judgment may. We now give a list of the Mutual Societies:—

Date.	Name of Society.	Periods of Division of Profits.
1706	Amicable	Annually
*1762	Equitable	10 years
*1806	London Life	Annually
*1815	Scottish Widows' Fund	7 years
1825	Scottish Amicable	7 ditto
1834	Mutual	Annually
1835	Metropolitan	5 years
1835	National Provident	Annually
1840	Productive	Annually

It would be quite superfluous to give any detail of these societies, beyond what has been done before, farther than to observe, that it need not be wondered, when the non-mutual societies exceed in variety the mutual societies by more than seven times their number, that so little should have been known by the public, of a system of provision for their families at once so equitable and so great as mutual assurance.

We have seen many hundreds of benefit societies most eagerly embraced by the public, simply because no acts of theirs were kept secret from the several members; and will it not be believed universally, that when a society presents to its assurers, as does a mutual society, all its overplus gains every year, and exhibits to every member the real transactions of the society, which is the surest testimony of its stability and honesty; and, farther, when every member has the same prerogative given him in the management of its affairs, whenever a meeting is called for business—will it not be believed, we ask, that to the parent whose solicitude is a provision for his family, a way is opened superior to all others he found before, and which he will warmly greet? And we also believe, where *one* father has now secured—convinced that it is a sacred duty incumbent upon him—a dependance for his widow and his fatherless children; when that hour shall come, *thousands* will fly to the advantages which are every day offered for this purpose, when the objects of Mutual Societies are better known and more encouraged in their laudable undertakings; since it is a fact, that this is the only system that will or can ever lead the public to partake largely of the benefits of Life Assurance. SIGMA.

* These do not give all their profits at each division.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 103.)

HERE commences the last excavation on the line; it is a mile and a half in length, and forty-five feet deep, and crossed by various bridges. Emerging from this cutting, an embankment commences, a mile in length and thirty-eight feet high, containing 339,332 cubic yards of earth. From this position a view is obtained of the beautiful surrounding country, and the spires and gigantic chimnies of the far-famed and unrivalled Birmingham. A little farther on is seen the viaduct of the Grand Junction Railway, and crossing the Lawley Street Viaduct, 730¾ feet long, and 46¾ high, we enter the Birmingham station, 112¼ miles from London. At this station omnibuses are in attendance to convey passengers to all parts of the town; fare sixpence. There are also hackney-coaches and cars, but the fares are rather higher than in London.

BIRMINGHAM, sometimes called *Brumwycham* in old writings, was celebrated for its manufacture of iron articles by the earliest writers upon record. Mr. Hutton, the historian, is of opinion, that this manufacture existed at the time of the ancient Britons; and, in support of this assertion, remarks, that "upon the borders of the parish stands Aston furnace, appropriated for melting ironstone, and reducing it into pigs; this has the appearance of great antiquity. From the melted ore in this subterranean region of infernal aspect, is produced a calx or cinder, of which there is an enormous mountain. From an attentive survey, the observer would suppose so prodigious a heap could not accumulate in a hundred generations; however, it shows no perceptible addition in the age of man." Leland describes the appearance of Birmingham in the time of Henry VIII. as follows:—"The beauty of Birmingham, a good market town in the extreme parts of Warwickshire, is one streete, going up alonge, almost from the left ripe of the brooke, up a meane hill by the length of a quarter of a mile. There be many smithes in the town, that use to make knives and all manner of cutting tools; and many loriners that make bittes; and a great many naylers; so that a great part of the town is maintained by smithes, who have their iron and sea-coal out of Staffordshire."

From the Restoration to the present time, Birmingham has gradually increased in population and commercial importance,

and is now the greatest manufacture of almost every description of hardware goods in the world. To enter into a description of this vast emporium, would lead us beyond the limits and intention of this work; here, therefore, we respectfully take leave of "the courteous reader," leaving him to admire the perseverance, industry, and talent, which, from a small community of blacksmiths, have erected the greatest manufactory that ever existed, and obtained for Birmingham the appellation of "*the toy-shop of the world.*"

ITINERARY OF THE LONDON AND BIRMINGHAM RAILWAY.

(The principal Stations are printed in SMALL CAPITALS, and the intermediate ones in *italics*.)

[*The first column denotes the number of miles from London, and the second, miles from Birmingham.*]

MIDDLESEX.		
EUSTON GROVE terminus	0	112¼
Camden Town, Park Street bridge	1	111¼
Primrose hill tunnel, 1120 yards in length	1½	110¾
Kilburn bridge	3¼	109
Kensal green tunnel, 320 yards in length	4¾	107½
Brent river viaduct	7	105¼
Harrow road viaduct	8	104¼
Kenton lane viaduct	10¼	102
Harrow Station	11½	100¾
Hatchend bridge	12¾	99½
Dove House bridge	13¼	99
Weald bridge	13¾	98½
HERTFORDSHIRE.		
Oxhey lane bridge	14½	97¾
Watford heath	15¼	97
Watford heath bridge	15½	96¾
Coln river viaduct	16¾	95½
WATFORD STATION and bridge over the St. Alban's and Rickmansworth road	17¾	94½
Watford tunnel, one mile in length	18½	93¾
Hunton bridge and Leavesden green road viaduct	20	92¼
Primrose green bridge	21½	90¾
Nash mill iron bridge, over the Grand Junction Canal and river Gade	22	90¼
Viaduct over the London road	22½	89¾
Twowaters, Hemel Hempstead, and Bovingdon road viaduct	23	89¼
Boxmoor Station and viaduct over London road	24¾	87½
Viaduct over the Grand Junction Canal	25¼	87
Viaduct over the Berkhamstead and Hemel Hempstead road	27½	84¾
BERKHAMSTEAD STATION	27¾	84½
Northchurch tunnel, 360 yards in length	28½	83¾
Northcote Court viaduct	30¼	82
Wiggington and Aldbury viaduct	31	81¼
TRING or PENDLY STATION at Tring summit, and Tring and Aldbury viaduct	31¾	80½
BUCKINGHAMSHIRE.		
Pitstone green	34¼	78
Seabrook bridge over the Grand Junction Canal	34¾	77½
Aylesbury Railway	35¼	77
Cheddington	36¼	76
Horton	37	75¼
Broughton Brook bridge	39¼	73
LEIGHTON BUZZARD or SOUTHCOTT STATION	40¾	71½
Linslade tunnel, 290 yards in length	41¼	71
Stoke Hammond viaduct	44¼	68
Fenny Stratford and Winslow road viaduct	45¼	67
Bletchly Station	46¾	65½
Denbigh Hall viaduct	47¾	64½
Woughton road viaduct	49	63¼
Loughton	50¼	62
Bradwell	51¼	61
WOLVERTON STATION and viaduct	52½	59¾
Castlethorpe	54½	57¾
NORTHAMPTONSHIRE.		
Ashton	58¾	53½
ROADE STATION	60	52¼
Blisworth Station	66¼	50
Grand Junction Canal viaduct	63	49¼
Bugbrook viaduct	66½	45¾
Stowe tunnel, under the London and Birmingham road, 400 yards in length	68¼	44
WEEDON STATION	69¾	42½
Brockhall bridge	71¼	41
Whilton bridge	72½	39¾
Long Buckby viaduct	73½	38¾
Grand Union Canal viaduct	74½	37¾
Crick Station	75¼	37
Kilsby tunnel, one mile and 640 yards in length	76¾	35½
WARWICKSHIRE.		
Hill Moreton viaduct	79¼	33
Clifton viaduct	82¼	30
RUGBY STATION	83¼	29
Long Lawford	85	27¼

Church Lawford	86¼	26
Brandon Station and viaduct	89¼	23
Brandon bridge............	89¾	22½
Sow viaduct	90¼	22
COUNTY OF COVENTRY IN WARWICKSHIRE.		
Sherborne bridge	92	20¼
Viaduct over the Coventry and Southam road............	92¼	20
COVENTRY STATION	94	18¼
WARWICKSHIRE re-entered.	75¼	17
Fletchamstead	95¾	16½
Beechwood bridge..........	98¼	14
Beechwood tunnel, 160 yards in length................	98½	13¾
Docker's lane bridge........	99¼	13
Berkswell bridge	99¾	12½
Wooton green viaduct	100¼	12
Blythe river viaduct........	102¼	10
Hampton Station and Birmingham and Derby Junction Railway	102½	9¾
London and Birmingham road bridge	104	8¼
Marston green viaduct	105	7¼
East Hall viaduct	105½	6¾
Sheldon viaduct............	106½	5¾
WORCESTERSHIRE entered	107½	4¾
Stichford bridge over the river Cole, and re-enter WARWICKSHIRE	109	3¼
BIRMINGHAM TERMINUS	112¼	0

NEW MODE OF PROPELLING STEAM-BOATS.

FALKIRK, July 7.—An ingenious mechanic, residing at Grahamstone, has been for a long period engaged in constructing a small vessel, to be propelled by means of pressure-pumps; the application of a principle quite new to the scientific world. On Monday evening the boat was launched into the Forth and Clyde Canal, at Bainsford Bridge, and proceeded beautifully along the reach at a rate of not less than fifteen miles an hour, conducted by the inventer alone, who worked the pumps. He is so much satisfied with his first experiment, that another on a larger scale is forthwith to be undertaken, and a patent procured to protect the invention. He has no doubt that it will, at no distant era, entirely supersede the present mode of propulsion by means of paddle-wheels.

Extraordinary Discovery.—We have heard that an humble Frenchman has found the means of fixing the electric spark for public lighting; and that it can produce a permanent flame of thirty inches in diameter, which would light a great part of Paris. The only danger attending it is said to be in the apparatus of supply, which may be isolated; as it is so strongly charged, that a person touching it would be struck dead immediately.

W. E. D.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 26, E. W. Brayley, Jun., Esq., on Igneous Geology. Friday, Aug. 28, Election of Committee. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Aug. 27, S. C. Horry, Esq., on Juries. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 26th, Mr. H. Wiglesworth, on Heat. At eight o'clock.

QUERIES.

The method of preserving fish as nearly as possible resembling life? I have seen some in several rod-makers' shops in London, and wish to know the process.

A YOUNG EXPERIMENTALIST.

How to bleach sponge? I have tried sulphurous acid without a proper effect.

A. B. Y. Z.

TO CORRESPONDENTS.

A Young Experimentalist (Lancaster) *having written with that signature during the last eighteen months, and observing that another worthy correspondent has adopted the same cognomen, requests, for the sake of distinction, that the latter would choose another signature, should he favour us with any farther communications.*

J. T. B.—*Birmingham to London, per railway,* 1*l.* 12*s.* 6*d.*, 1*l.* 10*s.*, 1*l.* 5*s.*, *and* 1*l.*; *London to Calais or Boulogne per steam,* 15*s.*; *Calais or Boulogne to Paris, per diligence, from* 12*s. to* 24*s.*; *and* 4*s. or* 5*s. for conductor's fee. No railway.*

A Subscriber *next week.*

J. N. D. *will find ample directions for preparing photogenic paper in No.* 39, *N. S., Vol. IV.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

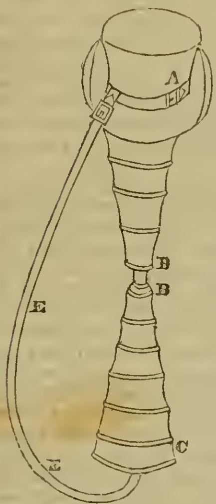
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

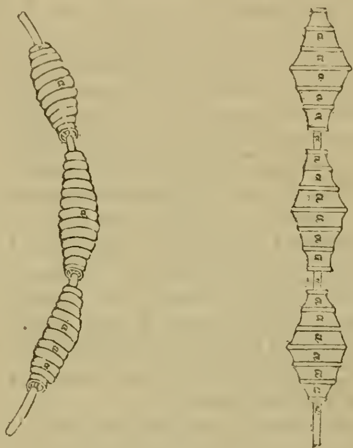
No. 107, NEW SERIES. SATURDAY, AUG. 29, 1840. PRICE ONE PENNY. No. 228, OLD SERIES.

FURNIVAL'S PATENT APPARATUS TO PREVENT PERSONS SINKING WHEN IN THE WATER.

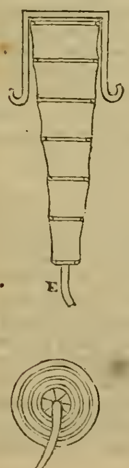
Fig. 1.



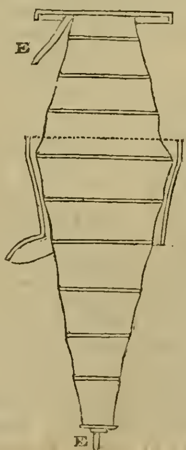
Figs. 2.



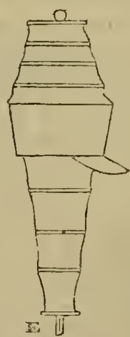
Section of Fig. 1.



As applied to a Soldier's Cap.



As applied to a Boy's Cap.



 City Press, 1, Long Lane: Doudney and Scrymgour.

FURNIVAL'S PATENT APPARATUS TO PREVENT PERSONS SINKING WHEN IN THE WATER.

(See Engraving, front page.)

The protection of life from fire or water, is a subject of too great and vital importance, to allow us to pass unnoticed any invention which appears likely to diminish the number of fatal accidents, which are almost daily recorded in different parts of the kingdom. As a hint for future improvements, as well as for the intrinsic value of the invention itself, we have procured for our readers the following abstract of Mr. Furnival's patent :—

"The invention relates, first, to the application of waterproof elastic bags or vessels to hats, bonnets, and caps, in such manner that persons may with facility use the same, in order to buoy themselves up when in the water, and can attach such bags or vessels to their persons with quickness, in the event of danger from shipwreck or otherwise; and at other times the apparatus is so arranged that the hat, &c., may be worn owing to the life-buoy or apparatus being within the hat, &c., and in no way interfering with the elegance of shape, and adds very little to its weight. I would remark, that I prefer the apparatus superadded to hats, should be of a fabric known as Mackintosh's waterproof fabric, and made as light as possible, by combining fabrics of as thin and close texture as possible.

And, secondly, the invention relates to a mode of constructing life-buoys more convenient for carriage when not in use, than those heretofore constructed ; and such buoys can more readily and quickly be employed, owing to the same not requiring inflating by the blowing into the same.

Description of the Drawing.

Which represents a hat having the invention applied thereto; and I prefer that the inner lining of the hat, or the hat itself, should be waterproof, whereby the hat may become part of the buoyant apparatus. The bags or vessels which I prefer to have applied as the apparatus, are of a conical figure, as shown at fig. 1, from A to B, and from B to C; and such apparatus as shown, consists of bags or vessels of waterproof fabrics, having light hoops of cane or whalebone, or other suitable material, to keep the vessels or bags distended when drawn out of the hat, as shown in the drawing, and in such manner that they will pack close when folded into the hat. E is a riband or band, to attach the hat to any part of the dress ; so that in the event of the person wearing the hat falling into the water, and the hat coming off, the same may not be separated from the person ; on the contrary, when so attached, it would immediately become the means of support to the person. But in case of persons having time to prepare before being in the water, such as in cases of shipwreck, the apparatus is so constructed, as conveniently to be attached to the person by means of the strings or bands, E F ; and such is the case in respect to persons in the water when they have presence of mind to draw the apparatus around them; the part from B to D is placed at the back of the person, and the hat and parts, C, is to be brought in front of the person, and the bands or strings, E F, being tied, the apparatus will be secured and held below the arms of the person, hence offering a life-buoy which will sustain and prevent a person in the water sinking.

Having thus explained the first part of the invention, I would remark, that the dimensions of the apparatus may be varied, depending on the weight of the person who is to use the same. And I would have it understood, that the shape of the apparatus or water-tight vessels applied to a hat, may be varied. In conclusion it will be evident, that although I have only shown the apparatus as applied to a hat, yet it will be readily perceived that a bonnet or cap, fitting the head of the person, may have the same description of apparatus applied thereto; the object of the invention being to apply suitable water-tight vessels of flexible materials in such manner, that, when out of use, the same will fold up and be within the hat, cap, or bonnet, and, at the same time, not interfere with the external shape of such hat, cap, or bonnet; for it will be seen from the above description, that it is only that portion of the hat, cap, or bonnet, into which the person's head enters, that is interfered with, in applying the invention, and so far the construction of hats, caps, and bonnets, is substantively the same; it will not, therefore, be necessary to enter into a farther description thereof.

The second part of the invention consists of constructing similar bags or vessels to those above described, as to be applied to hats, caps, and bonnets ; but in this case they are separate, and may be folded together into a very small compass, and may be carried in the pocket or other convenient part of the dress.

Fig. 2 shows two such bags combined together, and having suitable strings or straps to fasten them round the person.

These bags consist of waterproof flexible fabric of as light material as possible, and there are a series of hoops of whalebone or other suitable material, *a a a*, to distend the bags when opened out, in order to prevent them collapsing when pressed on by the water, and the person to whom for the time they may be attached.

Fig. 3 shows one of these life-buoys folded up when out of use. When it is desired to use one of these life-buoys, all that is necessary will be to draw the same out to its full extent, when sufficient air will pass through some of the joints of the fabric, or some portion thereof, to fill the same; but I prefer that all parts of the apparatus may be as air-tight as possible, leaving means for the air to pass in only at a small waterproof tube, which will conveniently form one of the strings for fixing the apparatus, and the buoy so extended will be kept distended by the hoops, instead of by the force of air forced or condensed in waterproof bags; as is the case with bags or vessels which are now used as life-preservers, and which require inflating by the person blowing into the same, which requires much more time, care, and thought, than many persons in times of danger possess; while buoys constructed according to the invention, simply require to be drawn round the person and fastened, by which sufficient inflation is produced, the requisite distension being obtained by the hoops. And I would remark, that I have found that sufficient air passes through ordinary waterproof fabrics, which I have made into such bags, without any other provision for the air to pass in, when the buoy is being extended; but if the fabric be wholly air-tight as well as water-tight, provision is to be made for the passage of air into the interior, as above described, when the vessel or bag is being drawn out to its fullest extent."

TULK'S IMPROVED METHOD OF MANUFACTURING IRON.

(Abstract of Specification.)

According to the ordinary means now resorted to for manufacturing of iron, by smelting iron ores in blast furnaces, the description of ores known as argillaceous ores are, and have heretofore been, those which have necessarily been employed, notwithstanding their being exceedingly poor of metallic iron; and it is only from the circumstance of the poverty of such ores, that the process now resorted to can be worked with advantage in the manufacture of iron, by the use of pit coal, or coke, or anthracite; and such process of manufacturing iron from argillaceous ores, as now practised, is inapplicable to the making iron in blast furnaces from the rich ores or oxides of iron, known as hœmatites, found in Cumberland and other parts; and such ores have only been used heretofore in the blast furnace, to a very small extent, in conjunction with poor argillaceous ores, and, in some cases, with the cinder of reverberatory furnaces used in the manufacture of iron. I believe that such rich ores or hœmatites have seldom, if ever, exceeded one-tenth of the ores in the blast furnace at one time; the quantity, however, may be more. Now the nature of my invention is such, that iron may be made by the use of a blast furnace, wholly from the rich ores or hœmatites, or oxides of iron; or such rich ores may, with greater advantage, be mixed in larger, and, indeed, in any desired quantities, with argillaceous ores, than could be practised by the means ordinarily pursued in reducing argillaceous ores with slight admixture of hœmatites.

It is well known to iron-masters, in the process of smelting argillaceous ores in blast furnaces, that lime is used as a flux, and that the result of working is, first, the metallic or cast iron (carburet of iron), and a glass or slag, which is produced by the combination of the lime used as a flux, and the silica and other impurities of the argillaceous ores; and the furnace-manager judges by the appearance of the glass slag, whether his furnace is working as he desires, in order to produce the description and quality of iron he wishes to make, and he accordingly applies more or less lime, by which he insures the conversion of more or less of the ore into carburet of iron, and, consequently, the silica and the other impurities into glass; and such glass protects the metallic iron from the prejudicial effects of the blast. Now on an examination or analysis of the rich ores or hœmatites, they will be found to possess a very small proportion of silica or materials for glass-making; consequently, unless the requisite quantity of glass for protecting the metallic iron when separated, be obtained from some other source than itself, hœmatites cannot be employed in large quantities, even when mixed with poor argillaceous ores; because those poor ores cannot be advantageously worked, if the glass slag produced therefrom be proportionably much reduced from that which now results from the present working, which would be the case, if large quantities of hœmatites were to be used with a given

quantity of argillaceous ores. My invention, therefore, consists in employing glass, or materials for glass-making, in proportion to the hœmatites used in a blast furnace, by which means such rich ores may be reduced with facility and advantage, and the cast iron or carburet of iron protected by the requisite quantity of glass, and the glass slag obtained in the process may be used over and over again. And, I would remark, that I do not confine myself to the employment of any particular description of glass or materials for glass-making, in carrying out this my invention; as the same may be varied according to the materials which can be most advantageously obtained in the vicinity of the particular iron-works, where my invention is to be employed: thus nearly pure sand-stone with lime are the materials I have employed, because such sandstone and lime can conveniently be obtained by me near the works where I have matured my invention; but other materials may be used, such as the slag of glass-works, and the glass or slag from the blast furnaces of iron-works, obtaining such slag or glass as free from sulphur as possible. And I particularly mention these matters, because they have heretofore been treated as refuse matters in the works, and may, therefore, be had at small cost in comparison with other known materials for glass-making.

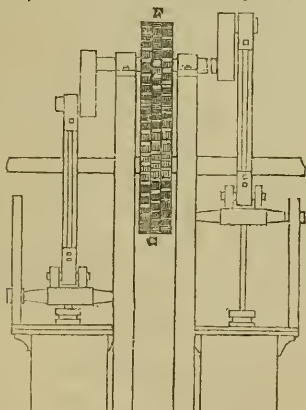
Having thus stated the nature and object of my invention, I will proceed to describe the means of making cast iron (carburet of iron) wholly from hœmatites or such like ores, by means of blast furnaces, as pursued by me; and in doing so I would remark, that the ores which I have worked with, are the Cumberland and Ulverston ores, which are very rich, and, on analysis, contain in one hundred parts of ore, about sixty-seven and two-tenth parts of iron, twenty-eight and eight-tenth parts of oxygen, only about four parts silica; consequently there would be very little glass slag produced by such a quantity of silica, when brought into combination with lime, or other proper material for making glass slag. And it should be stated, that in using more or less rich hœmatite ores, allowance is to be made for the quantity of silica and other impurities in the ores; and such is the case in respect to combining the use of hœmatite ores with argillaceous ores, in larger proportions than can now be done, when dependent on the glass slag, which will be produced from the silica and other impurities contained in the ores; but such allowance will readily be made in practice, after a little experience, the object being to employ such a quantity of lime or flux as will convert the whole of the silica into glass, and carry off other impurities, in order to prevent a silicate of iron being formed. In describing the process as pursued by me, I will suppose that the furnace used is an ordinary blast furnace; and I prefer to employ hot-blast. The glass mixture I have employed for smelting the very rich ores above alluded to, are ninety-three parts of silica to one hundred and one parts of lime; but I prefer to employ these fused into glass, to using the glass mixture in the blast furnace. According to the quality of cast iron I desire to make, I use more or less of the glass or slag, and I prefer in all cases to use the glass or slag to employing the matters for glass-making separately, before converted into glass; but, as before stated, the glass slag being once produced from this mixture, it may be used over and over again, the workman judging by the appearance of the slag, and applying lime as heretofore. In charging the furnace, I first throw in the coke, or coal, or anthracite, as usual, and then the glass or slag materials for glass-making is thrown in; then, again, the coke, and then the hœmatites or such like ores, broken small to about the size of hens' eggs, then more coke, &c., in this process, for a given yield of iron to that employed in reducing argillaceous ores. In charging the furnace wholly with hœmatites and with glass slag, I use about one part by weight of hœmatites to two parts by weight of glass slag, and if there be much silica in the hœmatites, I mix therewith some lime sufficient to convert the silex into glass, and carry off the other impurities. And it will be evident that, as the hœmatites contain more silica, and will, consequently, produce more glass from itself, the glass slag supplied into the furnace is to be reduced in proportion. The furnace in other respects is to be worked as heretofore practised.

ZANDER'S PATENT FOR IMPROVEMENTS IN STEAM-ENGINES, STEAM-BOILERS, AND CONDENSERS.

The first part of this invention is founded on the assumption, that there are a certain number of revolutions which the paddle-wheel of a steam-vessel ought to make in a given time, in order to obtain the most effectual re-action from the water, but always according to the velocity of the vessel's motion. In large vessels,

therefore, this number of revolutions becomes so diminished, that the velocity of the engine is lessened beyond the limit of convenient and profitable working. To remedy this defect, the inventer proposes to introduce a second motion, by means of which, the revolution of the paddle-wheel becomes relatively slower than in the ordinary construction, where the impulse is communicated directly from the beam, moved by the first power. This object is effected by means of cog-wheels of different diameters, varying according to the velocity required in the paddle-wheel, relatively to that of the engine. The lesser wheel is attached to the crank axle, and moves the larger one, which is fixed on the paddle-shaft. This mode of transmitting and modifying motion, is familiar to every one acquainted with machinery; and the inventer has not lost sight of the great difficulties attendant upon its application to the present purpose. Under the most favourable circumstances, the pressure upon the cogs must be immense; and the author acknowledges that the cogs must be very large, and, consequently, create much friction. He, therefore, proposes, in order to lessen this evil, a contrivance, the description of which we extract from his specification:—

"I divide the peripheries of the wheel, F and G, in two, three, or four parts, and



give to each cog in every part such a size, according to the power required from the engine to be by the wheel transmitted. Every cog in this division is fixed, so that, for instance, the peripheries are divided in four parts: one cog is a quarter before the joining cog in the peripheries of the wheel, divided in two parts; one cog comes, then, one-half of its breadth before the next cog, and so forward all with the divided parts; and the wheels are as, for instance, two, three, or four wheels being compounded. The wheels act, then, on each other, as if the pitch of their teeth had been two, three, or four times less, whereby you obtain a great advantage in having a less friction, but sufficient strength in the wheel teeth is gained. The wheel, G, is of a larger size than the wheel, F, according to the speed the engine should have over the paddle-wheel."

We cannot anticipate much advantage from this arrangement; and we think that Mr. Zander has underrated the pressure to which the cogs would be exposed, especially in a rough sea, and doubt whether any practical engineer would venture to adopt the plan.

The boiler is composed of a series of thin cast-metal chambers, very similar to Mr. W. Hancock's patent. (See "Mechanic," Vol. III. No. 112, O. S.)

The refrigerator is placed in a vessel filled with water, or other cooling medium, and the eduction steam from the working cylinder enters through a pipe, and being condensed into water, goes out through another pipe into the air-pump. The sides of the refrigerators are made of copper plates and of brass, "the distance between them being about half-an-inch, and, in order to keep them at this distance, and not to be pressed by the air, copper slips are applied half-an-inch wide, and placed edgeways and bent between the plates. The above-mentioned slips of plate are fixed in such a way, that their surfaces may detain the condensed water for so long a period as is possible during its descent. This is best effected by the slips being solely furnished with holes, or are folded in several separate places. The water that is formed by the eduction steam can only in a slow degree run down these slips, and form a water-surface on both sides of the slips, which is not even, but consists of great numbers of elevations and cavities. But in order still farther to detain this water surface, there are fixed between each row of slips, twisted brass or copper wires, from which the condensed water runs from and to them, and to and from the slips, and is formed into an infinite number of drops, and a constant circulation of the water is occasioned; which circumstance, as well as this great surface, is produced by this operation, and takes from the eduction steam its heat, and perfectly cools it when the valves are open, and before the piston reaches far on its way, but likewise easily

to deliver the heat to exterior plates, by communicating while the piston travels the rest of the stroke. This mode of steam condensing may be considered as a compound of condensing with injection water and condensing against metal plates' surface; because this water column, when performed on plates, divisions plates, slips, and brass wire, has time to communicate its heat while the piston performs the whole stroke."

ORIGIN OF GLASS.

THE precise period when the art of glass-making was first discovered, is unknown; but it is certain that the knowledge of the art is of the highest antiquity, having long preceded the Christian era. This fact is established by many circumstances, and among others, by that of glass beads and other ornaments having been found adorning the bodies of Egyptian mummies, which are known to have been upwards of 3000 years old. Glass is also mentioned by the Greek poet Aristophanes, 400 years before the birth of Christ.

The first manufactories of glass of which we have any account, were erected in Tyre, an ancient Phœnician city on the coast of Syria. The art afterwards extended to the towns of Sidon and Alexandria, which places also became famous for their glass ware. From Syria the art of glass-making found its way to Greece, and from thence to Rome, where a company of glass manufacturers established themselves in the reign of Tiberius. The seat of the art of glass-making in process of time changed from Rome to Venice, or rather to Murcano, a small village in the vicinity of that city. For many years the Venetian glass, in its various forms, supplied nearly the whole of Europe for that description of ware.

From Venice the art of glass-making found its way to France, where an attempt was made to rival the Venetians in the manufacture of mirrors in the year 1634; but subsequent attempts and improvements at length enabled the French speculators not only to rival, but excel, the Venetians; and about the end of the seventeenth century, they succeeded in casting plates of glass for mirrors, of a size which had been thought unattainable.

At what period the manufacture of glass was first introduced into England is uncertain, but there is reason to believe that glass was made so early as the beginning of the fifteenth century. This appears from a contract, dated 1439, between John Prudde, of Westminster, glazier, and the Countess of Warwick, to embellish a magnificent tomb for her husband, in which Prudde is bound to use "no glass of England, but glass from beyond the seas."

Glass windows, according to Bede, were first introduced into England in the year 647, to glaze the church and monastery of Weremouth. Another authority attributes the introduction of this luxury to Bishop Winifred, who died in 711; it seems, therefore, probable, that glass windows were first introduced into England about the end of the seventh or beginning of the eighth centuries. Previous to this, and for many centuries afterwards, the use of window glass was confined entirely to buildings appropriated to religious purposes, until the close of the twelfth century, when glass windows became common in England. In 1557, the finer sort of window glass was manufactured at Crutched Friars, in London. The first flint glass was manufactured at Savoy House, in the Strand, and the first plate-glass for mirrors, &c., was made at Lambeth in 1673, by Venetian workmen, brought over by the Duke of Buckingham. The date of the introduction of the art of glass-making into Scotland took place in the reign of James VI., in the year 1610.

At what period the art of simply staining, tinging, or colouring glass, was first discovered, is uncertain, but tradition says, that it was discovered by an Egyptian king; it is, however, certain, that the art was known in Egypt several thousand years since, the most beautiful imitations in glass of precious stones of all colours manufactured there, and of this antiquity, being still extant.

The first painted glass done in England was in the time of King John. Previous to this period, all glass of this kind was imported from Italy; but as early as the reign of Henry III., England boasted of several eminent artists in glass-painting. —*Glazier's Manual.*

THE CHEMIST.

ON ALKALIES.

(Continued from page 98.)

SANGUINARIA (Vegeto).—This alkali exists in the blood-wort, and was first separated by Dana. It is prepared as follows:— Alcohol is first digested on the root, which must be finely powdered. This tincture is filtered and mixed with ammonia; then poured into water; a precipitate falls, which yields the alkali to hot alcohol;

this, filtered through animal charcoal and evaporated, leaves the pure sanguinaria. It is white; soluble in ether and alcohol, but not in water. It combines with acids, forming salts of a red colour.

Soda (Vegeto).—This alkali is of the most extensive importance in the manufacture of soap and glass: it is greatly used in bleaching and in chemical researches. For commercial purposes, it is chiefly obtained by the decomposition of common salt by sulphuric acid. The following is the theory of this decomposition: Common salt (i. e. table salt) or chloride of sodium, is a compound of chlorine and sodium. Sulphuric acid of commerce is a compound of *dry* sulphuric and water: when the acid is poured on the salt, its water is decomposed, the hydrogen of which unites with the chlorine of the salt, forming hydrochloric acid, which is evolved; while its oxygen unites with the sodium, forming soda, which combines with the free sulphuric acid, forming sulphate of soda. The annexed diagram will illustrate this more fully; the original substances are printed in SMALL CAPITALS; the results of the decomposition in *italics* outside the braces, while their composition are in common type within the braces.

TABLE SALT.

Sulphate of Soda { *Soda* { Sodium / Oxygen

Chlorine / Hydrogen } *Hydrochloric Acid.*

SULPHURIC ACID + WATER.

The sulphate is converted into a rough carbonate, by igniting it in a reverberatory furnace with lime and coal-dust. The best proportions, according to Dr. Ure are sulphate of soda, 100 parts; carbonate of lime (chalk or limestone), from 110 to 120, according to purity; pit coal, 50 parts: the black ball produced by this process must then be broken into fragments and thrown into large iron cisterns, furnished with false bottoms of wooden spars. When the cisterns are nearly full of these lumps, water must be pumped in upon them, until they are all covered. After a few days, the lixiviation is effected, and the ley is drawn off either by a siphon or by a plug-hole at the bottom of the cistern, and run into evaporating pans. Another method of manufacturing crude soda is, by burning seaweeds into what is termed kelp or soda-ash, from which the soda is procured by lixiviation in the same manner as potassa. Pure soda for chemical purposes must be obtained from its carbonate; the same formula will answer for this alkali, as given under potassa. Caustic soda is white, of a fibrous texture; corrosive upon animal matter. Its specific gravity is 1.536.

It is curious that both soda and potassa combine with *transparent* olive oil, and produce *opaque* soap, while they unite with *opaque* sand, and form *transparent* glass. Soda may be distinguished from potassa by not forming a precipitate either with tartaric acid or chloride of platinum, which the latter never fails to do. It is also distinguished by giving a yellow flame to burning alcohol; holding it, or any of its salts, in solution. Soda was decomposed with the same phenomena as potassa by Sir H. Davy. According to his analysis, it is composed of

Sodium	74.6
Oxygen	25.4
	100.0

Anhydrous soda can only be obtained by burning sodium in dry oxygen gas.

Solania (Vegeto) is an alkali that was discovered by M. Desfosses, in the berries of the common nightshade. Several able chemists have treated them according to his directions, but have only obtained a small quantity of phosphate of lime, without any solania whatever; it has, however, been obtained from the filtered juice of the berries (in which it exists in combination with malic acid), by treating it with ammonia, which causes a grey precipitate. This, collected on a filter, washed with water, treated with alcohol, then filtered through animal charcoal, yields by evaporation pure solania. When pure, it is a pearly-white opaque powder; has no smell; its taste is slightly bitter, which becomes more sensible by solution in acids, more particularly the acetic. It is insoluble in cold water, and hot only takes up 1.8000 parts of its weight. Its alkaline characters are but feebly manifested by its action on tumeric; it, however, restores turnsol that has been reddened by acids. It is composed of

Carbon 62
Hydrogen 8.9
Nitrogen 1.6
Oxygen 27.5

100.0

G. W. S. PIESSE.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Sept. 2, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Sept. 3, D. Mallock, M. A., on Astronomy and Physical Geography. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 2, Mr. Cavalier, on the Solar System physically considered. At eight o'clock.

TO CORRESPONDENTS.

W. C.—*The character formerly employed to abreviate the word* and, *was composed of the letters E and T. It has since been altered into &; but in modern printing it is seldom used. It is called by printers the* short and; *and some schoolmasters, and more especially schoolmistresses, teach children to call it* Hamper's and; *this appellation has not, however, obtained much beyond the above-named authorities.*

W. E.—*The number of musical sounds, considering only the distinction of grave and acute, is unlimited. Euler is of opinion, that no sound making more than* 7520 *vibrations, or less than thirty in a second, is distinguishable to the human ear. According to this doctrine, the limits of appreciable sounds, from grave to acute, is an interval of eight octaves; but as nearly the whole of this interval is practically employed in modern music, it is probable that the real limits of appreciable sounds are much more extended. An ordinary ear can easily distinguish* 1000 *sounds in progression from grave to acute, and a good critical ear an incomparably greater number. No more than three sounds and their reduplicates, can be combined together in perfect concord; they are the tonic, mediant, and dominant. The chords of the adjacent keys—viz. the subdominant and dominant, are composed of the same* relative *sounds as the tonic harmony, but formed upon different fundamentals. The most perfect harmony possible is composed as follows:—Tonic,* 8*th,* 12*th,* 15*th,* 17*th, and* 19*th; that is (in the key of C), C, c, g,* $\bar{c}$, $\bar{e}$, $\bar{g}$, *forming in the bass the octave; and, ascending, the fifth, fourth, major third, and minor third. Harmony is the periodic coincidence of two or more series of vibrations; in the foregoing example, during one vibration of the bass (C), the other sounds make respectively* 2, 3, 4, 5, *and* 6 *vibrations. Hence is deduced a corollary, which should never be lost sight of in symphonic composition—viz. that the greater intervals, octaves, and fifths, should be employed in the bass, and the lesser intervals reserved for the upper parts, whenever the chief design, and intended effect of the composition will permit it. The fifth, major third, and minor third, with their inversions and reduplicates, are the only concords in music. In the organ, piano-forte, and other imperfect instruments, there are, indeed, only twelve sounds comprised in an octave; but the correct execution of the various modulations which occur, especially in modern music, requires a great many more. Our correspondent states, that he has been informed by a* teacher of music, *that there are no more than seven sounds! The seven notes which form the major diatonic scale, are derived from the chords of the tonic, subdominant, and dominant;—ut, mi, sol, from the tonic; fa and la from the subdominant; and si and re from the dominant. In the minor mode, one more sound, at least, is required to form the leading note, which is always a major third to the dominant. So far from this being the whole number of sounds recognised in music; it is, in fact, the least possible number with which a complete scale can be formed, and will admit of no complete modulation whatever, without the introduction of other sounds. The peculiar voice or* timbre *which distinguishes different sounds, is occasioned by the confluence of extraneous vibrations with the principal ones which decide the tone. The great bell of St. Paul's produces a perfect chord, the fundamental note of which is B flat, and the predominant sounds, B flat and F its dominant. Vibrating strings are always accompanied with the harmonic vibrations of their aliquot parts, which impart a peculiar sweetness to their sounds; there are also many circumstances, independent of the vibrations of the sonorous body itself, which materially affect the quality of its sound; the same string, for instance, will produce different sounds when placed on different instruments, owing to the auxiliary vibrations of the instrument itself. Some sounds are so complicated, that no place can be assigned to them on the scale, as grave or acute; such is the falling of rain, the rustling of trees, when agitated by wind, or a great number of strings tuned to different notes, and simultaneously struck. These are more properly called* noises.

Viator.—*We lament an accident on a railway, as we lament an accident by fire, or at sea, or by any of the perils impending on humanity; but it should be borne in mind, that every accident that happens on a railway, renders railway travelling more secure, inasmuch as it directs attention to the defective construction or improper management which caused it, and thus leads to the application of a remedy to prevent its recurrence.*

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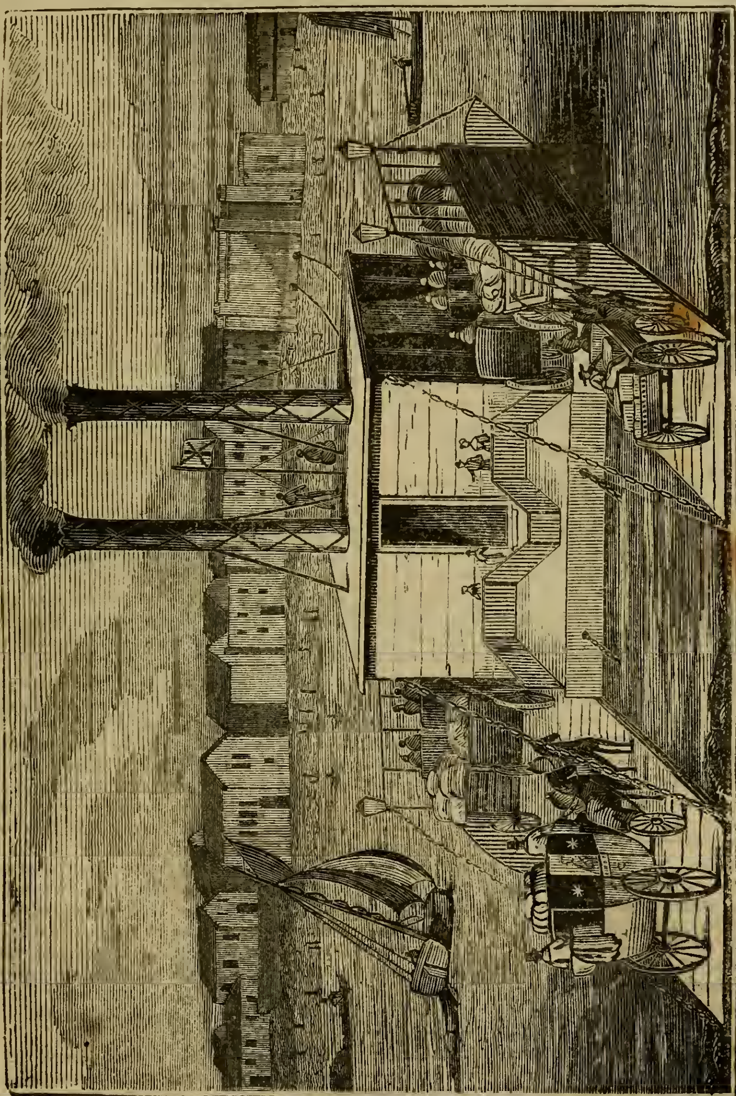
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 108, NEW SERIES. | SATURDAY, SEPT. 5, 1840. PRICE ONE PENNY. | No. 229, OLD SERIES.



THE PORTSMOUTH AND GOSPORT FLOATING BRIDGE.

City Press, 1, Long Lane: Doudney and Scrymgour.

THE FLOATING BRIDGE.

(See Engraving, front page.)

We this week furnish our readers with a sketch of the new Floating Bridge plying between Portsmouth and Gosport. The facility which it offers for crossing the harbour to vehicles of every description, has been attended with considerable benefit to the latter town. A bridge of a similar kind plies upon the Itchen—a small river breaking off from the Southampton water; but this bridge is very inferior to the other, both in size and speed. We believe that on the former, as many as 500 persons have passed over at once, besides vehicles of various kinds. The passage of about a mile and a half occupies, we suppose, about eight or ten minutes, and is performed with the greatest safety and accommodation. This bridge is worked by means of two steam-engines of considerable power, and runs upon chains, as shown in the engraving, to prevent its being drifted out of its track by the tide, which ebbs and flows at this part of the harbour with considerable power. We are informed that another bridge is constructing of a similar kind, which, when in operation, will start from either shore every quarter of an hour, instead of, as at present, each half-hour.

ROEDERER'S PROCESS FOR PREPARING ACETATES.

(Abstract of Specification.)

The various processes which have hitherto been employed for the formation of the acetates, and in particular the acetate or sugar of lead, consisted in mixing the base with liquid acetic acid, either in a concentrated or weak state. But this mode of operating is productive of many serious disadvantages, among which may be mentioned, the expense of fuel, of apparatus, of labour, and of time, the loss of acid, and the difficulty of producing acetates capable of perfect crystallization and of pure quality. Most of these disadvantages are obviated, and the remainder considerably moderated by my improved process, which consists in employing the acid in the state of vapour, to act upon the bases, instead of using it in the liquid form. I provide a vessel of adequate capacity for the quantity of acetate I wish to make at once, and constructed of such material as will not be readily destroyed by the acid. The top of this vessel I close hermetically by a cover, fastened down by any convenient means; and in the lower part of the vessel I place either a minutely perforated false bottom, or a coiled tube of several convolutions, minutely perforated, to permit vapour to pass through freely. To prevent the loss of acid, I also place, at different degrees of elevation, several perforated diaphragms, similar to the false bottom just mentioned, on each of which I spread a layer of litharge (if I am making acetate or sugar of lead, or a layer of other proper base, according to the acetate required); after which the cover of the vessel is to be accurately closed. By means of an ordinary distillatory apparatus, I convert liquid acetic acid (strong or weak, pure or impure) into vapour, which vapour I conduct by means of a pipe, into the convoluted perforated pipe before mentioned, or between the real bottom of the vessel and the perforated false bottom; hence the vapour passing through the numerous perforations of the false bottom and diaphragms, diffuses itself throughout every part of the vessel, its acid entering into combination with the base employed, and forming the acetate, which falls to the bottom of the vessel, and, in its descent, meets with the ascending streams of vapour, the acid of which renders it perfectly neuter; meanwhile, the more aqueous parts of the vapour become liberated, and, maintaining their temperature, ascend; and, in their passage through the successive layers of the base, are thereby deprived of their remaining acid. The vapour, thus reduced to simple steam, is allowed to escape through one or more pipes, at the top of the vessel; and as this steam still maintains a boiling temperature, I conduct it through a worm, to evaporate the acetas or the mother liquor by its heat. The distillation of the acid is continued, until the acetate in the vessel is arrived at the proper degree of concentration for crystallization; which is easily ascertained, by examining a small quantity drawn off by a cock at the bottom of the vessel, by which cock the whole contents are discharged when the operation is completed.

As the operation draws to its close by nearly all the base having combined with the acid, the vapour issues out of the vessel charged with a certain portion of acid; and, in order that no loss may be sustained by its escape into the atmosphere, it is conducted into another vessel prepared like the first mentioned, but charged superabundantly with the base, to take up every particle of the acid issuing out of the first vessel, until the operation in that first vessel is ended.

The great saving of fuel effected by my process, is evident from these circumstances, that my operation finishes where

the ordinary one begins, and that the mother liquor is evaporated by the latent heat of the aqueous vapour before it is discharged. The apparatus is extremely simple and cheap; being also self-acting, much labour is avoided by it; and, finally, as the temperature of the solution or the acetate can never exceed that of the vapour, the crystalline product is of finer quality than ordinary.

DESCRIPTION OF ELECTROTYPE.

To the Editor of the Mechanic and Chemist.

SIR,—Owing to the various queries of your correspondents as to the method of making the electrotype apparatus, I am induced to lay before you an account of this interesting discovery, as explained by Mr. Spencer, of Liverpool, before the Liverpool Society.

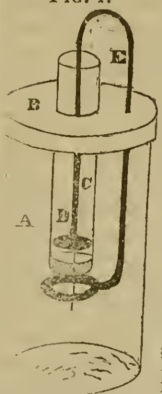
F. WEISS.

Liverpool.

The process consists in precipitating copper from its solution upon medals, moulds, &c., so as to produce exact fac-similes; every line being as delicate and sharp as the original, and so easy to manufacture, that it is impossible to err in the process, or to fail in its fulfilment.

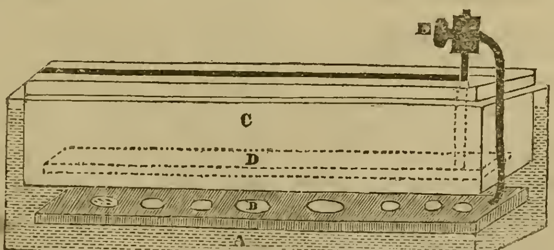
"My first essay was a piece of thin copper plate, having about four inches of superficies, with an equal-sized piece of zinc, connected together with a piece of copper wire. I gave the copper a coating of soft cement, consisting of bees' wax, resin, and a red earth (Indian or Calcutta red). The plate received its coating while hot. On cooling, I scratched the initials of my own name rudely on the plate, taking special care that the cement was quite removed from the scratches, that the copper might be thoroughly exposed. This was put in action in a cylindrical glass vessel, about half filled with a saturated solution of sulphate of copper. I then took a common gas-glass, similar to that used to envelope an Argand burner, and filled one end of it with plaster of Paris, to the depth of three-quarters of an inch. In this I put some water, adding a few crystals of sulphate of soda to excite action; the plaster of Paris serving as a partition to separate the fluids, but sufficiently porous to allow the electro chemical fluid to permeate its substance. I now bent the wire in such a form, that the zinc end of the arrangement should be in the saline solution, while the copper end should be in the cupreous one. The gas-glass, with the wire, was then placed in the vessel containing the sulphate of copper. It was then suffered to remain, and in a few hours I perceived that action had commenced, and that the portion of the copper, rendered bare by the scratches, was coated with the pure bright deposited metal, whilst all the surrounding portions were not at all acted on."

FIG. 1.



In order to illustrate the foregoing and following experiments figs. 1 and 2 are introduced. In fig. 1, A is a glass, or other vessel, holding about a pint; B is a wooden cover, fitted on to the top of it; C is the lamp glass, fixed in the middle of the cover, and furnished with the plaster-of-Paris bottom; D is a wire, having a piece of zinc at the bottom of it; E is a second wire passing through the wooden top, and bent below, where it has the plate of copper fastened to it. Fig. 2 is an apparatus

FIG. 2.



upon a larger but similar construction; A is a square glass vessel; B, a plate of copper holding several medals upon it, all of which are either united by soldering to the copper plate, or else united to it by a drop of quicksilver on the edge of the medal;

C is a box made of plaster of Paris, fitting into the glass box, A, but prevented touching the bottom of it, either by props underneath, or else protecting ledges at each end; D is the plate of zinc; E is the screw that binds together the two wires. By this simple apparatus, a number of objects may be made at once.

"*To Engrave in Relief on a Plate of Copper.*—Take a plate of copper, such as are in use among engravers; it is not essential that it should be highly polished. Have a piece of copper wire, neatly soldered to the back of it, and then give it a coating of the cement already mentioned. This is best done by heating the plates as well as the wax; or, to level the wax after it has had a coat, hold the back part of the plate over a charcoal fire or spirit lamp, taking care to hold it level; then write or draw the design on the wax with a black-lead pencil or point. The wax must now be cut through with a graver or steel point, taking especial care that the copper *is exposed on every line.* It must now be immersed in dilute nitric acid (aqua fortis), say three parts water to one acid; it will be at once seen whether it is strong enough, by the green colour of the solution, and the bubbles of nitrous gas eliminated. Let it remain long enough to allow the exposed lines on the plate to be slightly corroded, that the wax (which gets into the pores of the copper during the heating process) may be thoroughly got rid of. Practice will determine this better than any rules. The plate is now ready to be placed in the voltaic apparatus. After the voltaic copper has been deposited in the lines engraved in the wax, the surface of formation will be found to be rough, more or less, according to the quickness of the action. To remedy this, rub the surface with a piece of smooth flag or pumice-stone with water; then heat the plate and wash off the wax ground-work with spirits of turpentine and a brush. The plate is now ready to be printed from at a common press.

To deposit a solid Voltaic Plate, having the lines in Relief.—Take a plate of copper, lead, silver, or type-metal, of the required size, and engrave on it, to the depth requisite to print from when in relief. Contrary to ordinary engraving, the lines must be flat at the bottom, and as nearly as possible of the same depth; when so engraved, should the plate be copper or silver, heat it, and then apply a little bees' wax (what is termed virgin wax is preferable), mixed with a very small proportion of spirits of turpentine, and give the plate a coating of it. It may be laid on in a lump; and the heat of the plate should be sufficient to melt it. When on the eve of cooling, the plate should be wiped clean, and all the wax taken off, as sufficient will have entered the pores of the slate, to prevent the voltaic copper from adhering. Then solder a piece of copper wire. The plate must now receive a couple of coats of thick varnish on the back and edges (a preparation of shell-lac and spirit of wine does very well). I prefer, if the plate is large, to imbed it with plaster of Paris or Roman cement, in a box the size of the plate, allowing the wooden edge of the box to project just as much above the surface of the plate, as you wish the thickness of the voltaic one to be: care must be taken to keep the engraved surface of the plate clean. It is now ready to be placed in the apparatus to be deposited on. Should the plate be lead, or, what is still better, type-metal, the preparation of wax does not require to be given to the plate; as, when it deposited on to the given thickness, applying heat is sufficient to loosen them."

(*To be continued.*)

LAUNCH OF H.M.S. ST. GEORGE, 120 GUNS,

From the Dock-yard, Devonport, Aug. 27, 1840.

Precisely at half-past five o'clock on the above day, the last shore was removed —the "St. George"—that magnificent specimen of British art, received her name; and, amidst the cheers of myriads, the band playing "Rule Britannia," gracefully kissed the wave of that ocean on which we hope she will long remain a monument of England's glory. The space she had but just so nobly occupied, presented to the eye a densely-peopled amphitheatre, of such magnitude, as could not fail to produce strange feelings at the change that had so suddenly and almost imperceptibly occurred. The Royal Marine band was stationed near the platform, at the bow, and played some of the choicest national airs. We were much struck with the taste displayed in forming the admiral's booth, which was tastefully decorated with flags of different nations, surmounted by the flag of Lord Exmouth, under which he fought at Algiers, and which oft had "braved the battle and the breeze." The number of persons launched in the *St. George*, amounted to about 1500.

The *St. George* takes her place among first-rates of the first-class. She mounts

120 guns, and will have a complement of 820 men. Her dimensions, which have been furnished from good authority, are as follows:—

	Ft.	In.
Extreme length from figure-head to taffrail	247	0
Breadth extreme	55	3
Length of the gun-deck	205	11
Ditto of keel for tonnage	170	5
Height aft, from taffrail to keel	64	0
Ditto afore, from figure-head to keel	58	0
Length of lower deck	205	6
Breadth for tonnage	54	9
——— moulded	53	11
Depth of hold	23	2
Burden in tons, old measurement	2719—17	94
Ditto, new measurement	2670	
Length of fore mast	118	0
Diameter of ditto	0	40
Length of main mast	127	0
Diameter of ditto	0	42
Length of mizen mast	86	0
Diameter of ditto	0	26
Length of bowsprit	75	0
Diameter of ditto	0	40

FORCE AND CALIBRE.

Lower deck—Four guns to throw 8-inch shells, and two 32-pounders.
Middle deck—Two guns to throw 8-inch shells, and three 32-pounders.
Upper deck—Thirty-four 32-pounders.
Quarter-deck and forcastle—Six long 32-pounders; one 32 lb. carronade.

To build a ship of the magnitude of the *St. George*, will require nearly 6000 loads of timber; and allowing that each tree will, on an average, produce two loads, it would take about 3000 trees to furnish timber for such a ship. Now, it has been estimated, that thirty trees of full growth will cover an acre of ground; consequently, it will take 100 acres to produce sufficient timber for a ship of this class; and, as timber of large scantling is from eighty to a hundred years coming to its full growth, the quantity of land required for navy timber in this country, must be immense. This is a serious question, it being well known that there was an alarming scarcity of oak in this country in the time of war. Foreign timber is, therefore, introduced very extensively in ship-building.

The cost of building a similar ship to the *St. George*, has been computed as follows:

For labour alone	£15,643
Materials	77,878
Total cost	93,521

This will give 34*l.* 7*s.* 10*d.* per ton for building. The value of labour appears to be very nearly one-sixth of the whole; and the value of workmanship to materials about in the ratio of one to five. At the above rate of earnings, which allow about 5*l.* 15*s.* per ton for workmanship, it would take 200 men twelve months to build the ship.

It will scarcely be credited, perhaps, that the average durability of British men-of-war has been estimated to be only thirteen years! This we believe to be correct; so that the annual expense of keeping our fleets in efficient condition, may be said to amount to one-thirteenth part of the original cost of the whole. This is an important and striking fact.

The *St. George* was first ordered to be built in September, 1820; but it was not until the spring of 1827 that her keel was laid. In the course of the following year she was in frame, and was then left standing to season till 1832, when she was proceeded with by degrees, as the other works of the yard would admit.

Having been ordered to be built at a time when the late Sir Robert Seppings (then surveyor of the navy) was introducing extensive improvements in the practical department of ship-building, she was originally intended to be constructed throughout in strict conformity with his plans; but the alterations which have since taken place—more in detail, perhaps, than in principle—have led to corresponding changes in the works of the *St. George*. Hence it will be found that Sir R. Sepping's plans are adopted in many cases in a modified form. The original system of "oblique riders" and "trusses," for example, has not been introduced in the same manner, nor so extensively, *in the hold*, as originally intended; nevertheless, the diagonal principle has been maintained to a great extent in that part of the interior of the vessel. Diagonal decks have been altogether abolished; but the shelf-pieces have been retained, and the truss-pieces between the ports on the gun and the middle-decks strictly preserved. The stern has undergone the greatest change—a change for which the country is indebted to Mr. Roberts, the late master shipwright of this dock-yard, who suggested a plan for constructing sterns, at once elegant and effective.

The "quarter galleries" are not exactly as they were designed by Mr. Roberts, but have been lengthened a little in a fore-and-aft direction, and thereby improved, at the suggestion of Mr. Hawkes, the present master shipwright, under whose able

directions the ship has been finished, and by whom she was launched.

The figure-head is a full-length representation of St. George and the Dragon, but he has no horse—he is standing with his left foot on, and is slaying the dragon. The dimensions of the figure, measured in a vertical direction, are fourteen feet, and upwards of twenty feet if measured obliquely. It consumed about 200 cubic feet (or four loads) of fir timber (Quebec yellow pine), and cost, in addition to labour of "roughing it out," 100*l.* for the carving alone. It was designed and executed by Mr. Frederic Dickerson, of Plymouth, whose talent in this interesting department of the arts has procured for him a general order from the Lords Commissioners of the Admiralty, to execute all the carved work required for men-of-war at this dock-yard.

The *St. George* being of the same size and form as the *Caledonia*, the calculations which apply to the latter may be regarded as applicable to the former. The difference, if any, is unimportant. When launched, she will draw 15 ft. 1 inch forward, and 18 ft. 4 in. abaft.

The light displacement, or weight of the ship's hull, estimated from this draft of water, will be 2400 tons ; the area of the corresponding water-section (or plane of flotation) will be 8440 feet; and the weight required to sink the vessel an inch, under those conditions, will be twenty tons. But, before the ship goes to sea, she will have to receive on board her armament, powder and shot, masts, yards, sails, rigging, anchors, cables, boats, water, stores, provisions, ballast, men, and their effects. These, it is calculated, will immerse her until she draws 24 ft. 8 in. forward, and 26 ft. 1 in. abaft. In this case, the weight of the ship and its contents will be 4784 tons, making an addition of 2384 tons beyond the weight of the hull alone. And it is a curious circumstance, that the weight of the ship should be nearly equal to the weight of its contents and equipment. The area of the load-water section, or plane of flotation, when equipped for sea, will be 10,012 superficial feet ; and the weight required to sink the vessel one inch, will, under the circumstances, be nearly twenty-four tons. These are useful facts, because they show what weights should be taken on board to produce a certain immersion, or the weight which it may be necessary to take out of the ship, to lighten her to any desired draft of water.

As soon as convenient, she will be taken into dock for the purpose of removing the fixed fitments of the launch, and to be coppered. A first-rate will take 4000 sheets of copper (four feet long and fourteen inches broad), the weight of which is about twenty tons, and the value, including workmanship, something more than 2000*l.*

The quantity of sail capable of being spread upon spars of the dimensions in the table, is very great. It has been calculated to be 25,620 superficial feet! The surface of sail set upon the main-mast alone, has been estimated to be 10,273 superficial feet; the sails on the fore-mast, including the jib, 10,246 sup. feet; and those on the mizen-mast, 5101 sup. feet. By this it appears, that the sails set up on the fore-mast, including the jib, expose, as nearly as possible, as great an area to the action of the wind, as those on the main-mast; and that those belonging to the mizen-mast are equal in area, or nearly so, to one-fifth of the whole surface of sail.

The ballast which a ship of this description will take to sea, amounts to above 300 tons. She was launched with fifty tons in her hold ; and if she be placed in ordinary, she will ultimately receive on board about twice the sea-going quantity, it being considered that ships at their moorings do not strain so much when partly laden.

THE ADVICE OF A PHILOSOPHER.

Take especial care that thou delight not in wine, for there never was any man that came to honour or preferment that loved it ; for it transformeth a man into a beast, decayeth health, poisoneth the breath, destroyeth natural heat, brings a man's stomach to artificial heat, deformeth the face, rotteth the teeth, and, to conclude, maketh a man contemptible, soon old, and despised of all wise and worthy men ; hated in thy servants, in thyself and companions ; for it is a bewitching and infectious vice. A drunkard will never shake off the delight of beastliness ; for the longer it possesses a man, the more he will delight in it, and the older he groweth, the more he will be subject to it; for it dulleth the spirits and destroyeth the body, as ivy doth the old tree ; or as the worm that engendereth in the kernel of the nut. Take heed, therefore, that such a careless canker pass not thy youth, nor such a beastly infection thy old age ; for then shall all thy life be but as the life of a beast, and after thy death thou shalt only leave a shameful infamy to thy posterity, who shall study to forget that such a one was their father. Anacharsis saith, the first draught

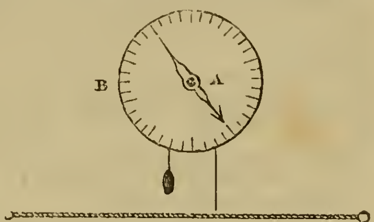
serveth for health, the second for pleasure, the third for shame, the fourth for madness; but in youth there is not so much as one draught permitted; for it putteth fire to fire; and, therefore, except thou desire to hasten thine end, take this for a general rule, that thou never add any artificial heat to thy body, by wine or spice, until thou find that time hath decayed thy natural heat; and the sooner thou beginnest to help nature, the sooner she will forsake thee, and trust altogether to art. Who have misfortunes, saith Solomon, who have sorrow and grief, who have trouble without fighting, stripes without cause, and faintness of eyes? Even they that sit at wine, and strain themselves to empty cups. Pliny saith, wine maketh the hand quivering, the eyes watery, the night unquiet, a stinking breath in the morning, and an utter forgetfulness of all things. Whoso loveth wine shall not be trusted of any man, for he cannot keep a secret. Wine maketh man not only a beast, but a madman; and if thou love it, thy own wife, thy children, and thy friends, will despise thee. In drink, men care not what they say, what offence they give, forget comeliness, commit disorders; and, to conclude, offend all virtuous and honest company, and God most of all, to whom we daily pray for health, and a life free from pain; and yet by drunkenness and gluttony (which is the drunkenness of feeding) we draw on, saith Hesiod, a swift, hasty, untimely, cruel, and an infamous old age. And St. Augustine describeth drunkenness in this manner:—"Drunkenness is a flattering devil, a sweet poison, a pleasant sin, which whosoever hath, hath not himself; which whosoever doth commit, doth not commit sin, but he himself is wholly sin." Innocentius saith, "What is filthier than a drunken man, to whom there is stink in the mouth, trembling in the body! which uttereth foolish things, and revealeth secret things; whose mind is alienate and face transformed? There is no secrecy where drunkenness rules; nay, what utter mischief doth it not design? Whom have not plentiful cups made eloquent and talking?"—*Sir Walter Raleigh.*

MISCELLANEA.

Animated Plants.—In No. 60, N S., of your Magazine, I perceived an article headed "Zoological Society," in which it is stated that Mr. Mackay had discovered an insect, the legs of which, after a certain time, take root; it being changed into a plant. That the seeds of certain plants might easily be mistaken for insects, is a thing not difficult to conceive, since we have an example in what has been called the *animated oat* of seeds, when wetted, acquiring a kind of locomotive power. The animated oat has two long awns, not very dissimilar to the legs of a grasshopper; when the water percolates these, they necessarily become distended, and the body of the seed is put into motion; by degrees it is turned over, and made even to skip; although not with quite the vivacity and force of a shrimp or a grasshopper, yet in a manner really surprising and amusing. I think the foregoing explanation accounts, in some measure, for the mistake (for mistake I must call it) of Mr. Mackay.

FELIX WEISS.

The Hygrometer.—The variations in Rutter's hygrometer would be much better seen, if the silken thread be brought up over a pulley, that carries at one of its extremities a light index or hand, A. In proportion as the cord lengthens or



shortens, it will cause the pulley to turn in one or the other direction, and, by a necessary consequence, the index turns likewise; the motion of which may be measured on the circumference of a graduated circle, B, about which the index performs its revolutions, as in the wheel barometer.

E. L.

Effects of Weather on the Animal System.—The human body, it is well known, is pervaded with that subtle fluid termed electricity. It operates on the animal economy as a direct stimulus; and by many physiologists it is believed that the electrical fluid is identical with the nervous energy; in other words, that the power of the nerves really consists in electricity, which, whether as a distinct fluid or not, pervades them. Therefore moist winds, coming in contact with bodies possessed of more electricity, will rob them of part of their electric fluid, until an equilibrium is effected between the earth and air. Now as the human body readily parts with and receives electricity, it will follow that it must afford a ready point for the transmission of this fluid by the surrounding atmosphere, and the symptoms of depression naturally ensue. This sufficiently explains the influence of every different kind of weather in exciting or depressing the nervous energy of the animal system in any season or climate.

Cure for Toothache.—At a meeting of the London Medical Society, Dr. Blake stated, "that he was able to cure the toothache (unless connected with rheumatism) by the following remedy:—Alum reduced to an impalpable powder, two drachms; nitrous spirit of ether, seven drachms. Mix and apply them to the tooth."—*Lancet.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Sept. 10, W. Vesalius Pettigrew, M. D., M.R. C.S., on the Anatomy and Physiology of the Organ of Hearing. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 9, Lecture and Discussion:—Is Atmospheric Air a Chemical Compound?—Mr. Thomas. At eight o'clock.

QUERIES.

What kind of oil, &c., is it that is used for making both the black and yellow oil-cloth, and how prepared and used? J. W. S.

1. What is the best method of making sealing-wax? 2. What is the best method of making wafers? 3. A description of the process of polishing lenses? G. THURLBY.

How is the chromatic fire cloud produced, that has been exhibited with such success lately in the various institutions at Manchester, London, &c.? A. K.

The best receipt for preparing and gilding calf, roan, and other leathers? JOSEPHUS.

A receipt for cleaning kid gloves?
A. C. R.

Having made the French polish according to the receipt in No. 118, Vol. III., and used it according to the directions inserted in the same Number, upon a square piece of wood as a pattern, and have put on as many as twenty coats of polish; and yet the middle of the piece of wood is as dull as ever, while all round the sides is a beautiful polish. I should like to know where I am wrong. Perhaps your correspondent "W. G. A. H.", who sent you the article headed "French Polish" in No. 101, will inform me of the whole process through the medium of your Magazine, and thereby greatly oblige

EXPERIMENTAL MECHANIC.

ANSWERS TO QUERIES.

Indian Glue.—"H. Hill," of Cork, is informed that Indian glue is known by the name of *Vancouvre's cement*, and is used for the purpose he mentions.

Metal Healds.—Having seen in your publication of the "Mechanic and Chemist," a query, asking if the metal healds for weaving linen, woollen, cotton, silk, &c, are in use, or likely for answering; I, as the patentee, beg to inform your correspondent, that they are in use at different places in this town, and do answer well. If your correspondent should wish to try them, he may obtain them from me.

JOHN OSBALDESTON.

Blackburn.

[The insertion of the above has been delayed in the expectation of receiving some farther description of the invention from the patentee.—ED.]

TO CORRESPONDENTS.

W. E. jun.—*Charcoal may be used for steam-engine models, but it would be inconvenient in a small close room.*

To cut gold and silver leaf into round pieces (or any other form), it is only necessary to use an ordinary stamp, and cut through the whole book. The intervening paper will prevent the metal from ruffling or tearing.

Iron work may be preserved by laquor, applied in the same manner as upon brass. If made with clear gums and coloured blue, the appearance is very handsome.

There is a substance about the consistence of size, which, when put upon shoes, &c., produces a durable, glossy black, without the application of friction. It is a valuable secret of the craft, and extensively employed for goods intended for exportation.

Description of Perkins's steam-gun in a future Number.

Multum in Parvo *will be noticed in our next.*

T. Hedgcock *proposes the following original query:—Why should a time-keeper, chronometer, or any piece of mechanism similarly made, not proceed perpe ually, until its parts are worn out, when wound up, or partly so, if the key is secured, as it always proceeds while so winding and being so set in motion; why is this not considered the nearest approximation to perpetual motion?? By its principle in mechanics, air-pumps, hydraulics, and loom power, or any vehicle or machinery, ship or vessel, might be propelled by the application of its power, and, in a time-keeper, its rate uniform.*

THOS. HEDGCOCK, Master R. N.

We trust there are but few of our readers who need a voice from the "City Press," to tell them that the motion of a machine cannot be perpetuated by arresting the power which is the source of that motion; but as the suggestion proceeds from a gentleman who is the author of an expensive work on astronomy, longitude, &c., we will briefly explain the fallacy of the notion. During the operation of winding up a chronometer or watch, the action of the main-spring is suspended; so that the machine would stop, and the required isochronal progression would be deranged, were it not for a contrivance which supplies a temporary power to maintain the motus during the short period of winding. This apparatus is called a going fusee, and can be shown and explained by any watchmaker. It is usually calculated to continue its action from one to two minutes, and when it is exhausted, all progressive motion must cease.

ERRATUM.—Page 136, col. 2, for "per steam 15*s*." read 15*s*. and 10*s*.

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

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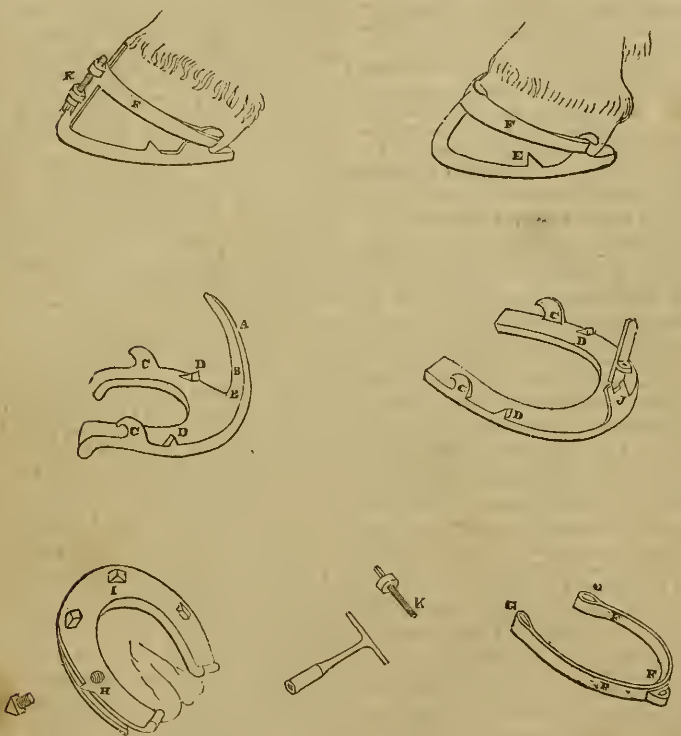
DE GOURNAY'S PATENT HORSE-SHOES.



City Press, 1, Long Lane: Doudney and Scrymgour.

DE GOURNAY'S PATENT HORSE-SHOES.

(*Abstract of Specification.*)

This new invention of a horse-shoe, which may be made of any kind of metal, either simple or compound, forged or cast, the bridle or band of which may also be of leather, metal, or any other material, simple or compound, consists of an ordinary horse-shoe, of three specific parts only. First, the shoe, properly called the bridle or band, and a small point stop or catch, called in French, "*talus*," which enters the wall of the hoof. This shoe is an ordinary shoe, furnished with one or two clips or crotchets, A, drawn out from the mass, or soldered, and situated on the fore-part or toe at the extreme border of the shoe. The shoe may have one or two roughs or teeth, B, in the interior.

Two ears or stays, C, drawn out from the solid or soldered. The branches of the shoe are pierced for the talus, D, which are rivetted in, placed in an inclined direction of a form somewhat triangular, and may be in number from two to eight; these talus enter the wall of the hoof, in a small notch, which is cut for the purpose.

The ears or stays serve to receive the extremities of the band or bridle, F. This band or fillet may be made as before described, of different material, but is mostly of iron: it has the form of a circular arch, and represents on the hoof a sort of V. It is made in such a manner, that the ends are turned over and rivetted, forming a sort of loop, G, at the end, in which is placed the ears or stays; it then passes over the crotchet or clip, of which the extremity is curved and rivetted.

For winter, the shoes are pierced (H) for screws, I, which are placed and displaced at pleasure, and made of iron or steel. Cogs may also be placed and removed in the same manner.

In case of disease or defect, the crotchet or clip has a hinge, J, which communicates with the band by means of screws, K, which work upwards. This mode prevents the necessity of using the hammer on the hoof, and facilitates the stepping of the horse. It preserves the hoof in a state of cleanliness, which is very desirable during dressing. This last system may be applied equally to young horses and race horses, which are frequently shed and unshod.

DESCRIPTION OF ELECTROTYPE.

(*Continued from page* 148.)

"*To procure Fac-similes of Medals, &c.*—This may be done by two different methods; the one, by depositing a mould of the voltaic metal on the face of the metal (having first heated it and applied wax), and then depositing the metal, by a subsequent operation, in the mould so formed. But the more ready way is to take two pieces of melted sheet-lead (cast-lead not being equally soft), having surfaces perfectly clean and free from indentation. Put the medal between the two pieces of lead, subjecting the whole to pressure in a screw press; a complete mould of both sides is formed in the lead, showing the most delicate lines perfect, in reverse. Twenty, or even a hundred of these may be so formed on one sheet of lead, and are deposited by the voltaic process with equal or greater facility; as the more extensive the apparatus, the more regularly and expeditiously does the operation proceed. Those portions of the surface of the lead where the moulds do not occur, may be varnished, to neutralize the voltaic action; or, a whole sheet of copper being deposited, the voltaic medals may afterwards be cut out. A piece of wire must now be soldered neatly to the back of the leaden plate; it is then ready to be put in action.

A Voltaic Impression from a Plaster or Clay Model.—I took two models of an ornament, one made of clay and the other of plaster of Paris, soaked them for some time in linseed oil, took them out, and suffered them to dry; first getting the oil clean off the surface. When dry, I gave them a thin coat of mastic varnish. When the varnish was as nearly dry as possible, but not thoroughly so, I sprinkled some bronze powder on that portion I wished to make a mould of. This powder is principally composed of mercury and sulphur. I had, however, a complete metallic coating on the surface of my model, by which I was enabled to deposit a surface of copper on it, by the voltaic method I have already described. I have also gilt the surface of a clay model with gold leaf, and have been successful in depositing the copper on its surface. When the plaster or clay ornament is gilt with gold leaf or bronzed, a copper wire should be attached to it, by running through from the back, until the point appears above the front surface, or level with it, will be sufficient. The other end must then be attached to the binding screw connecting it with the zinc, in all respects similar to any of the foregoing methods.

To obtain any Number of Copies from an already Engraved Copper Plate.—A copper plate may be taken engraved in the common manner, the lines being *intaglio.* Procure an equal sized piece of sheet-lead, lay in on the engraved side of the plate, and put both under a very powerful press; when taken out, the lead will have every line in relief that had been sunk in the copper. A wood engraving may be operated on in like manner; as lead, being pressed into it, will not injure it. A wire may now be soldered in the lead, then bed it in a box, and put into the whole voltaic apparatus, when a copper plate, being an exact fac-simile of the original, will be formed. In this process, care must be taken that the lead is clean and bright as it comes from the roller in the milling process, and, consequently, free from any oxidation, which it soon acquires if exposed to the atmosphere. It should be put in action as soon as possible after being taken out of the press.

To Copy a Wood Engraving.—I may premise that, but for the plasticity and perfectly unelastic property of lead, the discovery would be of but comparatively small value. Plumbers, who have handled the substance for the greater portion of their lives, are astonished to find it so susceptible of pressure; on the contrary, wood engravers did not, until now, imagine their blocks would stand the pressure of a screw press on a lead surface without injury; but such is the fact in both instances. In the manner in which box-wood is used for wood engravings, being horizontal sections, it will sustain a pressure of 8000 lbs. without injury, provided the pressure is perfectly perpendicular. The wood engraving being given, take a piece of sheet-lead the requisite size; let its superficies be about one-eighth of an inch larger all round than that of the wooden block. The lead must now be planed with a common plane, just as a piece of soft wood. The tool termed by the joiner the try-plane does best. A clear bright surface is thus obtained, such as I have not been able to get by any other means. The engraved surface of the wood must now be laid on the planed surface of the lead, and both put carefully in the press. Should the engraving have more than two inches of superficies, a copying press is not powerful enough. Whatever press is used, the subject to be copied must be cautiously laid in the centre of the pressure, as a very slight lateral force will, in some degree, injure the process. The lead to be impressed upon must rest upon the iron plate of the press, as must the back part of the wood engraving; the pressure to be applied regularly, and not, as in some cases, with a jerk. When the pressure is deemed complete, they may be taken out; and if, on examination, the lead is not found to be completely up, the wood engraving may be neatly relaid on the lead, and again submitted to the press, using the same precaution as before. When the lead is taken out, a wire should be soldered to it immediately, and put into the apparatus without loss of time, as the less it is subjected to the action of the atmosphere the better. Care should be also taken not to touch the surface with the fingers. In the pamphlet, I stated the length of time usually taken to deposit the required thickness of metal. I have been since able to abridge that period three or four-fold, as I keep the solutions at a temperature of from 120° to 180° Fahrenheit. It has been suggested to me by Mr. Crosse, of Broomfield, to keep the solutions boiling, which still farther increases the rapidity of the deposition. Contrary to the general chemical analogy, the deposited metal is of a much superior quality to that deposited by the very slow action of a common temperature. At the time, it must be borne in mind, that if the process is quickened by strengthening the solution in the positive cell by the addition of an acid, the metal deposited in the opposite one is of a very inferior quality; so much so, as to be totally unfit for any practical purpose. Under these circumstances, the deoxidating process is not complete, the deposit being a reddish brown protoxide of copper; this last, if let remain for a few days longer, undergoes a still farther change; it then becomes a black oxide of copper, such as may be used for organic analysis; and were I to pursue this branch of chemistry, I should never resort to any other method for obtaining it. The above process will apply to copying engraved copper plates or medallions. I have also been able to obtain impressions from wood engraving by the following method:—Take a piece of tinfoil, the size, or thereabouts, of the engraving; place it on the engraved surface; after this, place a piece of sheet India-rubber, and put the whole in a press; on taking out of which, it will be found the tin is thoroughly impressed into the lines of the wood. A coating of plaster of Paris must now be laid on the tin to about half-an-inch in thickness; when set, the whole may be taken off the wooden block. It will be found that the tin adheres to the plaster, and leaves the face of the engraving. The tin surface may now be deposited to any required

thickness. The above was tried on a coarse wood engraving. I am unable to say how it might answer for a fine one."

FELIX WEISS.

(*To be continued.*)

LIFE ASSURANCE.

NO. VIII.

(Concluded from p. 134.)

IT cannot be expected that perfection exists in a large degree, where the work of experience has been comparatively small; indeed, it is a general opinion, that there are but few cases where perfection can exist at all. However, in reference to the subject of Life Assurance, we may rest satisfied the time is fast approaching, when it will be far better understood than it is at present; and when, we trust, those defects which we have now had occasion to notice in some parts of the system, will be wholly removed.

We shall not make it our business at present, to pass any farther encomium upon Mutual Societies, but leave them on the premises they now occupy, well convinced of their future success. But we have a feature to notice, which stands very prominent in the character of the last two societies we placed on our list, which we shall do without farther commendations on either. "The National Provident" was established in 1835, and the "Productive" in the present year. In both these societies there are offered some high advantages to the middling classes, which afford a great protection to their respective members; namely these: that those societies are empowered, under certain Acts of Parliament, that give them severally a wide scope of privileges, which are to be found enumerated in either of their prospectuses; and, besides this, the power to invest their funds at the National Debt Office, with a total exemption from all stamp duties whatsoever.

But we return for a moment, to reflect seriously upon the system of giving commissions, as practised by several societies, to which subject we made some allusion in the last chapter. It will not be supposed, surely, that we object to a suitable remuneration to such as bring assurers to an office? No such thing, we have only to condemn, in very forcible terms, the practice, which we hope farther to acquaint the reader with. Before the plan was adopted by societies of giving commissions generally, an excellent writer made the following remark:—"Many of the public companies who do not make any return of the profits to the assured, allow a liberal premium (generally five per cent. on the payment made) to any person who will procure an assurance to be effected at their office; and this commission is also allowed to any person who makes the annual payment, provided it be not the party himself!".* But, had the above writer been living in the present day, he would have seen much more to censure than there appears in his remark; for not only is the commission given by offices that do divide their profits, as well as those who "make no return," but there are competitors in the trade, whose object is to obtain a greater number of assurers, although it be done by fraudulent means. We will suppose a case of a solicitor, whose clients generally reside in the country; it is in many instances the case (some of them wishing to assure), that he receives instructions to assure certain lives at the office he thinks most proper to select; and, for the trouble of doing so, of course is paid his fee. Now the solicitor is constantly seeing prospectuses, which intimate that "the usual commission is allowed to solicitors," &c.; and he naturally expects, on bringing assurers, to receive the said commission, and this is well so far as it goes; but just reflect a moment, reader, upon the practice of such persons taking lives to assure in offices which allow the greatest premium—although, we trust, there are few base enough to do so—yet consider how wantonly that trust has been betrayed, which persons usually place in their legal advisers, when in the important matter of assuring for a family provision, their premiums are paid at an office possessing no claims to merit—for we hold they are such—merely for the sake of obtaining on the part of their legal adviser, some five or ten per cent. profit on such transaction! And, indeed, we feel ashamed to add that, in some cases, offices *privately* allow something more than this, upon every payment that passes through a solicitor's hands, amounting annually to a very considerable sum.

The means continually resorted to, to win solicitors and others over to this system of agency, we will not attempt to discover; but we think it is a very clear illustration of the saying, that "were there no receivers of stolen goods, there would be no thieves." It is but in justice to many societies to say, they have no hand in deceptions of this sort; and it is only those who are so assiduous in their advertisements

* Baily on Life Assurance, Vol. II., p. 507.

and other means of making themselves known, who are guilty of a growing evil we would fain crush in the bud.

In conclusion, we cannot refrain from inviting the public to a general scrutiny of the matter of Life Assurance; it is a subject of so great importance, that it cannot be too widely diffused; and we hail the day when every paper and periodical will have a column devoted to the investigation of a principle sound in its doctrine, and which, therefore, must be beneficial in its practice. True, we are advocates for no wild speculations, which are the only stimulants which gave rise to some of our societies; but we see enough in the world of knowledge daily to prove to us that, even on this subject, there will shortly be much of the ignorance removed that at present exists; and fathers and heads of families will embrace with cordial approval, a plan of relieving their affectionate partners in widowhood, and of protecting their fond and helpless little ones, when left orphans and desolate.

SIGMA.

FARTHER PARTICULARS OF THE PORTSMOUTH AND GOSPORT FLOATING BRIDGE.

(From a Correspondent.)

THE floating bridge is seventy feet long, sixty feet wide, and draws three feet water. It has two cabins, which, together with seats at the side of the cabins, would shelter about 150 people. She is capable of carrying 500 persons and six carriages, with a pair of horses each, or a proportionate number of larger or smaller carriages. Two chains, the links of which are of iron thirteen-eighths inches thick, are stretched across the harbour, being each 2200 feet in length. At both ends these chains are joined to others, which pass over rollers into a shaft twenty-four feet deep; to the end of each, a weight of about five tons is attached, which rises and falls in the shaft, according to the strain on the chains, and prevents the danger of their breaking, as they thus yield to the force of the wind and sea coming into the harbour. These chains pass in at one end of the bridge and out at the other, through grooves, with sheeves above and below, to keep them at a certain angle in passing over large iron wheels of twelve feet diameter. In the centre of the vessel, on each side of the steam-engine, the edge of these wheels is adapted to the links of the chain, which take a firm hold; and, as the engines move the wheels, the chain passes, and the bridge is thus propelled. The chains are raised from the bottom as the bridge passes, and descend again at a short distance from it; so that vessels pass in and out of the harbour, without being interfered with by these chains. The engines used are two of twenty-five horse power each. The advantages to the neighbourhood are very great, there being a considerable population on each side of the harbour, and very great intercourse with Southampton, particularly since the completion of the railroad to London. The distance round the head of the harbour is fifteen miles. Persons on foot might, of course, go in boats, but there was much difficulty in conveying carriages and horses over before this bridge was established; but now they pass over with as much ease as if they were going on the high road.

About 1500 persons and 100 carriages of various sorts, pass daily over on this bridge. The expense is about 5*l.* daily, without allowing for wear and tear, or interest of capital. The charge for a carriage and pair is 1*s.* 6*d.*; for a single person, 1*d.*; in the best cabin, 3*d.*

Another bridge is in preparation, with engines of increased power, to be in reserve in case of any accident, or the necessity of repairs, so that there may not be any interruption to the intercourse. The bridge is about seven minutes in crossing the harbour, and starts every quarter of an hour.

THE CHEMIST.

ON ALKALIES.

(Continued from page 143.)

STRONTIA (Earthy.)—This alkali was first discovered about 1787, in a mineral brought from the lead mines of Strontian, in Argyleshire, whence its name. In these mines it occurs in a crystalline state as a carbonate. It is found as a sulphate abundantly near Bristol, and sometimes crystallized. In order to obtain this alkali in a state of purity, the native carbonate may be treated in the same manner as that I have described for obtaining pure baryta.* Strontia is a greyish-white powder, infusible in the furnace. Specific gravity rather under baryta. It has a sharp burning taste, but not so corrosive as baryta, though more so than lime. It becomes hot when moistened with water, and slakes into a pulverulent hydrate. It is soluble in 150 parts of water. It is

* Baryta, page 234, Vol. V.

distinguished from baryta, by causing a precipitate with iodate of soda and fluosilicic acid; and by its soluble salts giving a red tinge to flame. The only preparation of strontia used in the arts, is the nitrate, which is mixed with the chlorate of potassa, sulphur, and charcoal, for forming the composition of those brilliant red fires, so much admired in theatrical conflagrations. Strontia, like all the other earthy alkalies, was proved by Sir H. Davy to be the oxide of a metal, which he called strontium. Strontia, according to his analysis, consists of

Oxygen	86
Strontium	14
	100

Strychnia (Vegeto.)—This alkaline base was discovered by MM. Pelletier and Caventou. It is the active principle of those poisonous seeds, "The St. Ignatius bean." Nux vomica owes its violent action on animals to its containing this alkali. It is best procured from the St. Ignatius bean, for which purpose these seeds are to be reduced into powder by a rasp, and digested in ether, by which it is freed from a thick oily substance; this being withdrawn, the mass is to be treated with alcohol, this solution is to be filtered and then evaporated, when it leaves a brownish yellow substance; this is to be dissolved in water, and treated with a solution of potassa; a precipitate falls, which, when washed with cold water, is white, crystalline, and extremely bitter. It is strychnine nearly pure. One of the principal properties of this alkali is, that when introduced into the stomach, it acts with frightful energy, causing lock-jaw immediately. Half-a-grain blown into the throat of a rabbit, proves fatal in five minutes. It is inodorous; is soluble in alcohol, but not in cold water; boiling water takes up two thousand five hundredth part. Its taste is so powerful, that a solution containing the six hundredth thousandth part, possesses it in a marked degree. In combination with acids, it forms crystallizable salts, which are colourless. By the analysis of Dr. Liebig, it is composed of

Carbon	77.0
Hydrogen	6.8
Oxygen	10.2
Nitrogen	6.0
	100.0

SEPTIMUS PIESSE.

A DANGEROUS DISCOVERY.

To the Editor of the Mechanic and Chemist.

SIR,—Some weeks ago I perceived in a Manchester paper, a reference made to a composition prepared in France, by which letters may be destroyed by the writer unknown to the receiver.

It appears, from what could be gathered from the paper alluded to, that the writer, after finishing his letter, washes it over with the preparation, which causes the paper to fade or moulder away in the course of a few days.

Now if any of your correspondents can introduce a receipt for this composition into the columns of the "Mechanic and Chemist," they will confer a boon on the generality of your readers, and partially do away with the adage, "Letters are strong witnesses." I have tried the muriatic, nitric, and sulphuric acids, but their action on the paper is too speedy, and they change its colour immediately. Perhaps an insertion of this letter may be the means of some interesting experiments being made on the subject.

I am, Sir, yours, &c.

F. HAYS.

Manchester.

[The injury that might be done by this process in the hands of fraudulent persons, is incalculable; bills, receipts, agreements, &c., would be cancelled, and ruin entailed upon thousands; but the antidote must be published with the discovery itself, so that the effect may be prevented, or the process discovered, before it is too late.—ED.]

EVOLUTION OF HEAT.

To the Editor of the Mechanic and Chemist.

SIR,—If I may be allowed to offer an opinion as regards the evolution of heat on the mixture of alcohol and water, it is the following:—All substances that have the greatest specific gravity, in my opinion, have the least latent heat, and *vice versâ*—hydrogen the most, and platina the least. Now when alcohol is added to water, it becomes dense; true, the water becomes lighter, the alcohol becoming denser, must give out a portion of its latent heat; and when water becomes lighter, it must receive a portion of heat which becomes latent. Now the quantity of heat given out by the alcohol, is more than is required by the water, and thus it becomes sensible to the thermometer. There is an exception to this rule, that is, water, which, though

lighter than mercury, still water parts with its latent heat sooner, and becomes solid.

I am yours, &c.

JUVENILE ENTERTAINER.

[When water and alcohol are mixed together, the specific gravity of the compound is greater than the aggregate specific gravity of the two separate liquids. A pint of water and a pint of alcohol, when mixed, will not measure a quart. This circumstance seems to corroborate the doctrine propounded by our correspondent.—ED.]

MISCELLANEA.

Fire-proof and Water-proof Cement.—To half-a-pint of milk put an equal quantity of vinegar, in order to curdle it; take the curd from the whey, and mix it with the whites of four or five eggs; beat them well together; add a little quick-lime through a sieve, till it has acquired the thickness of paste. With this cement, broken vessels of all kinds may be mended; it dries quickly, and resists the action of water, as well as a considerable degree of heat.

Preparation of Drying Linseed Oil.—To render linseed oil drying, consists simply in mixing it with litharge or any oxide of lead; boiling it slowly for some time, and straining it from the sediment after it has stood, to clarify. An ounce of litharge may be used to every pound of oil.

How to Colour Wood or Bone a Beautiful Red.—Take powder of Brazil, and mingle it well with milk, but so that it be very red, and put therein either wood or bone, letting it lie therein eight or ten days, and it will make the said wood or bone red for ever.

A Glue to hold against Fire or Water.—Mix a handful of quick-lime in four ounces of linseed oil; boil them to a good thickness, then spread it on tin plates in the shade, and it will become exceedingly hard; but may be easily dissolved over the fire, as glue, and will effect the business to admiration.

To Catch Kites, Crows, Magpies, &c., alive.—Get nux vomica, beat to powder; this done, take raw flesh or liver, and cut it into little pieces, that the fowls may swallow them whole; then cut holes in the same, and put your powder therein, and lay these pieces where they haunt; but as soon as they have swallowed the same, they will fly to the next tree they come at, and this presently makes them so drunk or sick, that they will fall to the ground; but be sure to watch them and run to the tree, for they will soon recover and fly away.

How to make a Sallad Grow up in Two or Three Hours.—Take lettuce and spinach seed, and soak them in warm oil for the space of half-an-hour; then have fat earth in a hot-bed, to sow them, covering them very lightly over with mould, and they will spring up to admiration, and presently leaf.

E. LEDGER.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Sept. 17, W. Vesalius Pettigrew, M.D., M.R.C.S., on the Anatomy and Physiology of the Organ of Hearing. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 16, James Smith, Esq., on Provident Institutions. At eight o'clock.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, September 14, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

In No. 91 of your valuable Magazine, there is a receipt by "E. Ledger" for compounding the chemical weather-glass. Well, Sir, I procured the ingredients, and in the exact quantities; pulverized and dissolved them; tied up the bottle, leaving a pin-hole in the bladder as directed, and exposed it to the atmosphere; but no such results took place as mentioned by Mr. Ledger. Thinking I might have made a mistake, I subsequently placed the receipt in the hands of two of the first chemists in this town, with the same results as when I compounded myself. I have several times seen the chemical weather-glass at a friend's house, who does not know the compound, but for which he paid seven shillings, being the price they are sold at in this town. It is a very good indication of the weather; but it presents a very different appearance in the bottle to Mr. Ledger's compound. Now, Sir, as there is evidently a mistake, perhaps Mr. Ledger will be so good as to set me right in your next week's publication. A. C. P.

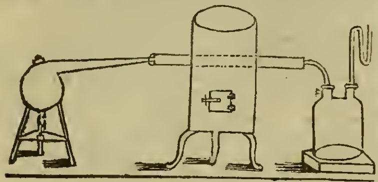
If any of the readers of the "Mechanic and Chemist" have for sale cheap, a small working model of a steam-engine, with or without boiler, they will oblige by sending particulars; and time when and place where the same may be seen, to Mr. Thomas, No. 38, Ludgate Street, City? C. THOMAS.

ANSWERS TO QUERIES.

"N. M. T." S. F. Gray says, that the catananche cœrulea is the blue gum succory; that its properties are aperitive, hepatic, and attenuant; roots, dried and powdered, used to improve (?) coffee. (Third edition, Suppl. to Pharmacopœia, 1824.

Sulphuret of Carbon.—Coat an earthen tube with clay, and pass it through a furnace. Put into the tube several pieces of newly-made charcoal, arranged so as not to choke up the tube; to one end attach a bent glass tube, jetted to a two-neck Wolfe's bottle, partly filled with water; to the neck of the bottle affix a safety tube. Let a small retort be luted to the other end of the tube, and into the retort put some sulphur. When the tube is red hot, put a lighted lamp under the retort; the sulphur will combine with the carbon of

the charcoal, and pass the tube, to be condensed by the water. It will sink into the water, and has a slight milky appearance. When no more gas comes over, detach the apparatus, and pour what has been obtained into a retort containing chloride of calcium; distil by a sand heat of 112° Fahr. It is extremely volatile, and must be kept



in a well-stoppered bottle. Some sulphuric acid put in a vial, and wrapped round with a rag dipped in sulphuret of carbon, presently freezes; and, owing to its almost instantaneous evaporation, it produces a most intense sense of coldness when applied to any part of the body.

Bird Stuffing.—There are many different methods of stuffing, three of which methods I will describe:—The most common method, but which does not answer well for small birds, is to pass wires up the legs and through the head; also into the wings, to make a frame-work for the body, which wires afterwards may be bent, according to the attitude in which the bird is to be placed; then fill up the skin with tow or cotton wool.

Another method, and which is to be preferred for small birds, is to pass a sharpened wire up each leg only, and then to fill up the skin in every part with cotton wool, moulding gradually the bird into its proper form as it dries, and supporting it with wool on every side until thoroughly dry.

Another method, which is peculiarly adapted for those of the genus colymbus, and all large and strong birds, is first to wrap up the bones of the wings with a little tow, and then return them into their proper position; then cut three pieces of annealed iron wire suitable to the size of the bird, sharpen the ends, and pass one through the skull, so as to form an artificial neck (the same size as the one removed) of tow or cotton wool, and wrapt tightly round with twine; two wires are to be passed up the legs, and the thighs made in the same way and manner as the neck. An artificial body is then to be formed and placed in its proper position. Then string the wires of the neck and thighs into their proper direction, and firmly fasten them by twisting the wires into the body. After they are so stuffed, the next business is to sew them up; in doing this, the needle is to be passed from the inside outwards, otherwise the feathers will be ruffled, and the specimen disfigured. Artificial glass eyes will also be requisite, which are to be fixed in with a little common paste, mixed with muriate of mercury; or glazier's putty will answer equally as well.

To Catch Rats.—Oil of rhodium (which is the product obtained by destructive distillation of common rose-wood), one part; carbonate of baryta, two parts; mixed up with a little common paste, and set in their haunts.

Stammering.—I do not believe that such a thing as an instrument to relieve stammering is or could be invented. As "A Sufferer" may probably not understand the cause of stammering, I will take the liberty, as well as I am able, to explain it to him:—Affixed to the front of the larynx (the upper part of the wind-pipe) is a small flap of cartilaginous matter styled the epiglottis, which serves a very important office—viz. the larynx being situated in front of the œsophagus (food pipe), the food eaten must necessarily pass over the entrance to the larynx, which, if it were to enter, would cause suffocation; but, to prevent that, while swallowing, the epiglottis shuts over the larynx, and allows the food to pass over and enter the œsophagus. Some of your readers may, perhaps, have experienced the effects of trying to speak whilst swallowing, as the epiglottis must open when you are proceeding to speak; the food of course enters and chokes the person. From this we deduce, that stammering arises from the muscles which raise the epiglottis being incapable of so doing, through a morbid state of the nervous system. Hence a person can sing or drawl out a sentence without stammering, as during that state, the epiglottis continues open. And the great secret of those empirics who profess to cure stammering, consists in making their patients to drawl out their words in quick succession, so as not to allow the epiglottis to close.

Congreve Fusees are made in the same manner as the Congreve matches; excepting German tinder being substituted for wood.

MANIPULATOR.

TO CORRESPONDENTS.

J. A. P.—*It was reported in the newspapers some time ago, that a French chemist had discovered a substance which, enclosed in a glass vessel, would exhibit a perpetual light; but the story did not appear sufficiently connected with truth, to create any interest in the scientific world. Phosphorus may be kept in a well-closed bottle, and it will emit a light when exposed to the air; but it is not unattended with danger.*

S. P.—*No.*

Joseph Rice (15, Duke Street, Manchester Square) *has invented an apparatus for preventing loss of life by shipwreck, &c. Besides fulfilling the indispensable conditions,—certainty of action, and facility of application—it appears, from the inventer's account, to possess the additional and important advantage of displaying a conspicuous signal. We have given our correspondent's address, in order to facilitate communications from our readers to the inventer. The expense of a patent would be about* 300*l*., *or perhaps rather more.*

S. J. W. *may address to Mr. Hedgcock, at the "Mechanic Office," and his letter will reach its destination.*

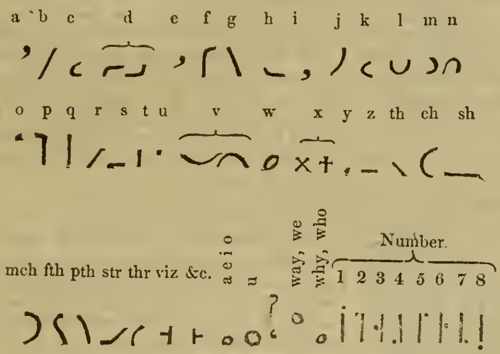
London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

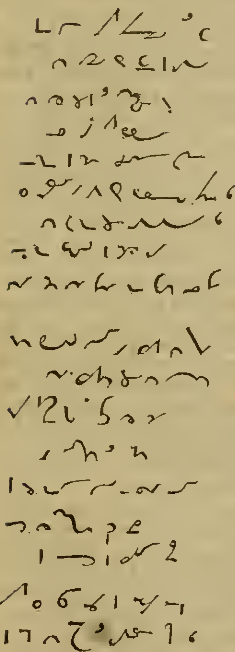
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 110 & 111, NEW SERIES. SATURDAY, SEPT. 19, 1840. (PRICE TWOPENCE.) Nos. 231 & 232, OLD SERIES.

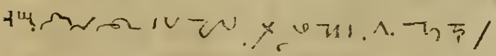
SHORTHAND.



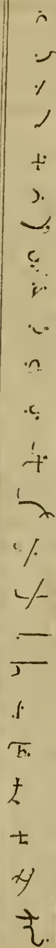


'Tis done—but yesterday a king
And armed with kings to strive;
And now thou art a nameless thing,
So abject, yet alive.
Is this the man of thousand thrones,
Who strewed our earth with hostile bones,
And can he thus survive?
Since he, misnamed the morning star,
Nor man, nor fiend, has fallen so far.

Thine evil deeds are writ in gore,
Nor written thus in vain;
Thy triumphs tell of fame no more,
Or deepen every stain.
If thou hadst died as honour dies,
Some new Napoleon might arise,
To shame the world again;
But who would soar the solar height,
To set in such a starless night?



ILLUSTRATIONS OF THE NUMBERS.



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acknowledge
exemplify

City Press, 1, Long Lane: Doudney and Scrymgour.

SHORTHAND.

The brevity of shorthand over all other modes of writing, consists in the simplicity of its alphabet, and its signs for the initial and concluding syllables of words. Besides this, to constitute a good system, not only must the greatest amount of language be exhibited by the fewest marks, but among those marks must be found the largest number of such as are easiest to make. In this, however, all that can be done is, to assign the easiest marks to those letters which are of most frequent occurrence; for the number of simple marks is limited to three, and, by position, to nine; a straight line in four positions, a curve in four positions, and a circle. The remainder of the alphabet must be made up by other contrivances. To effect this, some combine the circle with a straight line or curve. These lose a great advantage in representing the vowels, and rendering the writing legible. Others combine two straight lines to represent a character, which must introduce great confusion. An odd-looking sort of thing, published a year or two back, intended to supersede, not only all other systems of shorthand, but also common writing and printing, varies the simple marks in a wonderful manner, thickening and thinning them, in whole or in part, tailing them, and placing them at all imaginable angles. Indeed, the characters are actually laid down, with *scale* and *protractor*, in a geometrical scheme. Such crude attempts carry their own absurdity upon the face of them, and prove their writers to be mere experimentalists upon public credulity, and to know nothing of the first principles of shorthand, much less to have practised it. Blanchard, whose system I have always congratulated myself upon learning, uses characters of two sizes, small and large, as we have short and long letters in common writing; this is of the greatest possible advantage in exhibiting the vowels and primary and concluding syllables. The objection which some have made, as to the difficulty of preserving two sizes in swift writing, is no objection at all, as I can testify, from eighteen years' experience, both in my own practice, and the practice of many who have studied under me. In common writing, when written at the swiftest, it is easy to distinguish between *l* and *i*, *a* and *d*; and, to shorthand writers, shorthand is precisely the same. Some improvements have been borrowed from Mavor, and, indeed, from every other system that offered advantages. Time, much time, and much practice will be required before the learner can follow a speaker, and, to tell him otherwise, would be only to deceive him. If persons are not willing to bestow that time and practice, they must not attempt it, and there the matter rests. If an individual refuses to learn arithmetic, because three months' study of it will not make him master of the calculus, why, he must remain as he is. But, let it be clearly understood, that though it will require much time to write as fast as another speaks, yet three or four months' practice will enable any one to write three or four times as fast as in common writing, and, after a little public practice (for there is a knack in listening and writing at the same moment, which nothing but public practice can teach) to catch the *leading ideas* of moderate speakers, which is all that the best shorthand writers can accomplish in following *very rapid speakers*, and which, indeed, is all that is necessary. By taking the trouble to compare the reports of speeches in the daily papers, it will be found, that though the sense is the same, yet they are not verbally alike. At a future time, I may enter into detail, and explain several methods of abbreviation, which experience and time have suggested; for the present, the following will be sufficient to give the reader an idea of the manner in which he may proceed. Suppose a speech copied thus by two reporters:—"Lords Gemn. Eyes all Europe moment on you. From your resolutions, Protestant interest hopes protection well as friends, preservation independency; enemies fear final disappointment, ambitious destructive views. Let these hopes fears confirmed augmented by vigour unanimity dispatch proceedings." The translation of one might be:—"My Lords and Gentlemen,—The eyes of all Europe this moment are on you. From your resolutions, the Protestant interest hopes protection, as well as our friends the preservation of their independency; and our enemies fear the final disappointment of their ambitious and destructive views. Let these hopes and fears be confirmed and augmented by the vigour, unanimity, and dispatch of your proceedings." The other might give it:—"My Lords and Gentlemen,—The eyes of all Europe are, at this moment, directed upon you. From your resolutions, the Protestant interest confidently hopes for protection, as well as our friends for the preservation of their independency; while our enemies are overwhelmed with fear for the final disappointment of their ambitious and destructive views. Let these hopes and these fears, then, be confirmed and augmented by the vigour, the unanimity, and the dis-

patch of your proceedings." The first thing the learner must do, is to write the alphabet over carefully, committing perfectly to memory the words which the letters signify; which are the following:—

A, a, an	*n*, and, in
b, be, by, been *	*o*, oh, of
c, can	*p*, people, peace
d, did, day, do, done	*q*, question, quantity
e, ever, every	*r*, are, our, or
f, for, from, if	*s*, as, is
g, God, go	*t*, the, to, it
h, he, has, had, his	*u*, you
i, I, eye	*v*, have, save
j, Jesus, judge	*w*, which,
k, king, know, knew	*x*, exercise, extra
l, Lord, all	*y*, ye, your, yes
m, me, my, may, him, am	*z*, zeal.

th, they, that
ch, Christ, chapter, change
sh, shall, should
mch, much, inasmuch as
fth, faith, forth, father, farther
pth, path, pathetic
str, stir, star, store, strong, strength
thr, there, their, therefore.

The commas and dots for the vowels are used only when standing alone. In composition, a little circle is used for *u*, *e*, *i*, *o*; a larger one for *u* and diphthongs. When the small circle stands alone, at the top of the line, it signifies way or we; when at the bottom, why or who. Of the numbers, the first four are for primary syllables; the others for terminations.

No. 1 signifies com, con, coun, cum, ab, ob, trans.
No. 2. Au, aw, re, anti, inter, intro, inde.
No. 3. Pra, pre, pri, pro, pru, par, per, pir, por, pur, prin.
No. 4. Un, under, mis, mus, dis, dus, sub.
No. 5. Ary, ery, &c.; aty, ety, &c.; ify, ophy, &c.
No. 6. Ation, etion, &c.; assion, ession, &c.; ician, tion, ion, &c.
No. 7. Ant, ent, &c.; ate, ete, &c.; ance, ence, &c; anse, ense, &c.; ness.
No. 8. Ang, ing, &c.; li, ed, ful.

That is to say, a dot put in the position of No. 1, that is, above a letter, signifies com, &c.; thus, a dot with *n* under it, signifies common; and *k*, with a dot under it (No. 8), knowing; for *k*, of itself, stands for know, and the dot for ing; and so of all others. By using letters instead of the dots, three syllables may be expressed by one mark, as shown in the plate. It will be seen, that there are two *d's*, *v's*, and *x's*; either may be used; *j* is also substituted for *g*, when easier to join. The method of contraction will be best learnt from making out the title-page: no rules can teach it. Put just as many letters, consonants, and vowels, as will be sufficient to convey the sound; *x* is formed by making two letters cross each other, and is to be used for all such sounds as ack, eck, ick, &c. Should the learner find any difficulty, I shall always be willing to obviate it.

W. W.

* This letter is also sometimes used for *y* in composition.

ON THE ATTRACTION OF COHESION AND CAPILLARY ATTRACTION.

If two bodies be immersed in water, so that the tops of them be as much below the surface of the water as they will sink to, without the water spreading over their tops, I say they will repel or recede from each other; nor will any floating body or atom approach either of the bodies so immersed. But if the same bodies are permitted to float with their tops up above the level of the water, I say that they will approach each other, and every body floating on the surface of the water will approach all bodies so floating. The principle upon which this depends, is simply the adhesion of the particles of the water. We know that drops of water hang to the sides by reason of adhesion among the particles of water that make up the drop, by which every particle, to a certain amount of particles, is maintained, the water having a proper affinity to the side, &c. And we know, likewise, that water will be maintained up above the brim of any cup or dish, by reason of adhesion among the particles of the fluid, and the resistance it likewise meets with on the edge of the cup; and, lastly, we know that water, by reason of adhesion among the particles, will hang to the side of any body and will, if the body be placed in the fluid, hang from the body all round, like a ring slanting from the body down to the water in a sudden curve. Let us call this ring, of water a vortex; and if two bodies floating on the surface of the water, with their tops up above the surface, be brought so near to each other, that the vortex of the one body just touch the vortex of the other, I say they will then, and only then, begin to approach each other. The vortices extend from the bodies at the sur-

face of the water, about three-sixteenths of an inch.

You will see that the two bodies are connected together the moment the vortex of the one touch the vortex of the other, by reason of the adhesion among the particles of the two touching vortices of water. The vortex of the one body slanting down to the point of contact, and up again to the other body, forms a compound vortex of the two; and the instant the vortices touch, they will join to each other outwards on either side, if they happen to be convex to each other, by reason of the water naturally disposing itself from the most acute joining to the most obtuse and uncornered form it can assume. Now let the joining of the two vortices be any number of particles in breadth, and one particle of water in height; the bodies may not begin with this power to approach each other; however, let it be supposed they do begin to move, I say, then, the power that is at this moment drawing the two bodies together, is as the height of the row of particles multiplied by the weight of the row of particles in the section that divides the two vortices; and, of course, this is the measure of the adhesion of all the particles in the section. But it is evident the bodies will begin to approach each other, when the weight of the particles across the section of the compound vortex between the two bodies, is greater than the inertia or tendency the bodies have to remain at rest in the fluid; for particles at the section hang upon both bodies alike by virtue of adhesion to the particles which adhere to the bodies, and, of course, will fall down from between the two bodies, if they be not upheld by the bodies being prevented from following up the direction that the particles immediately in connexion to these in section, will necessarily be drawn to by the weight of the particles in the section. The weight of any part of the vortex round the bodies only hangs as dead weight on them, and can have no other effect on them, than what it had before the touching of the vortices. I allude to the sound parts of the primitive vortices, opposite to where they are connected between the two bodies.

Why the same bodies, immersed below the surface of the water, but not covered or wet by the water on the top, repel or recede from each other, follows almost as a corollary to the preceding case. It is evident that the vortex, suspended from the bodies floating above the surface, will now be suspending the body immersed beneath the surface of the fluid, by reason of the adhesion among the particles of the vortex, which rises up from the body about three-sixteenths of an inch, and vanishes into the surface of the water about four-sixteenths of an inch from the side of the body; the same distance from the body that the water will rise upon the body above the surface of the water, and the height of the surface of water above the top of the body, is the same as the distance the vortex will extend from the body above the surface, till it vanishes into the surface of the water, namely, three-sixteenths of an inch. Take one body with its depressed vortex of water, and let another body touch the vortex in any part at the top, it is evident that the level of the vortex at that place is broken and depressed by the weight of the body or its touching; if it be a body that will float on the water, it will instantly seek the highest place in the vortex, and will seem to be repelled from the body immersed; but if it be a body simply presented by the hand, the vortex and body will both seem to be repelled by the object; for, as the vortex will be broken by the object, it follows that the surrounding level of water will force against the body, to restore the equilibrium in the level of the vortex at the part depressed; for the same reason would the vortex and body seem to be repelled by a thin blade, if it be used to represent the single phenomenon more complex by bisecting or cutting the vortex in two, vertically to the side of the body. In this case, the two opposite sides of the vortex, having no support between them, the blade having severed the part of the vortex away that kept the whole complete like an arch, will instantly be forced by the surrounding weight of water to flow over to either side, till the whole level of the vortex be again complete between the immersed body and the blade. Two bodies, so immersed, will recede from each other to the distance of twice the height vortex stands upon bodies floating above the surface of water.

Of capillary attraction, as it is called, I say there is no such thing as attraction or repulsion about it; but simply the water rising, and maintained when up capillary tubes, by the adhesion of the particles of water to the sides of the tube; and, as I have observed in the preceding cases, regarding water being suspended from the sides of all bodies it has a proper affinity to. It may here be remarked, that no body whatever can have a vortex of water suspended from its sides, unless it be previously wetted above the surface of the water; therefore, I say, the capillary tube must first have a coat of moisture on

the inside of the tube before the water will rise in it.

In the first place, then, let a tube be furnished, that will exactly contain a vortex of water that will just fill the tube exactly, vanishing away from all points of the circumference, at a point in the very centre of the tube; I say such a tube shows the phenomenon of water rising up capillary tubes in its first and simplest form, and is actually all that we see in all tubes whatever. The quantity of water contained in this tube, is the greatest quantity that can be contained in a capillary tube less than it.

The quantities of water in all capillary tubes, are as the diameters of the tubes. The heights to which the water ascends in all capillary tubes, are reciprocally as their diameters; and, consequently, the surface by which the water is supported in all capillary tubes is the same. But I say, the weights of water in all capillary tubes, supported by the same unalterable surface, must be the same; for the weight of a column of water in the tube is as the height of the column multiplied by the area of its base: therefore, I say, if the first simple form of capillary attraction is only water supported by the adhesion of the water to the sides of the tube, every other expression of the phenomenon is maintained by the very same cause. This, then, is first the case when the wet lining of the tube touches the water. The particles of water immediately in contact with the particles of the lining of tube, are supported by the lining; for the power of adhesion of the particles to the tube, and among themselves, is shown to be sufficient to bear a weight equal to the first vortex, or equal to a drop of water, to be plainly understood. But the water being directly supported by adhesion to the height first of one particle, the particles immediately in connexion with the sides of the tube will dispose themselves, without any hinderance, up the tube, in a form common to the most relieved condition of their surface, which will be, as on all other surfaces or floating bodies, a curved top, slanting up to the particles immediately above themselves; and, as the particles in the very centre of the tube, multiplied by their height, are not so heavy as the adhesion is of the particles to the tube, and, among themselves, is strong, I say, the water will actually be drawn up the tube by the slanting particles that dispose themselves up the tube from the surface of the water; for, as I have already observed, the slanting particles are supporting no weight, till once the area of the column of water, multiplied by its height, be equal to the power of adhesion of the whole surface of particles.

I am, Sir,
Most respectfully yours,
M. Sproule, Eng.

LEIGH'S IMPROVED MODE OF OBTAINING WHITE LEAD.

(Abstract of Specification.)

Firstly, I take a quantity of the lead ore, called galena, say eighty-nine hundred weight, reduced to moderately fine powder, and to this I add so much nitric acid diluted with water, as shall dissolve the lead of the galena—say one hundred and fifty hundred weight of nitric acid, of the specific gravity 1.3, diluted with three or four times its bulk of water; by the aid of a gentle heat, the acid and galena readily act on each other, and a solution of nitrate of lead is formed. To this solution, when clear, I add a concentrated solution of common salt, or chloride of sodium, so long as any precipitation of chloride of lead takes place; then the chloride of lead having subsided, and the supernatant liquor being decanted, I wash the chloride of lead with fair water, adding the first washings to the previously decanted liquor, which will consist of a solution of nitrate of soda; but I do not confine myself to this mode of making the chloride of lead, as it may be made in various other ways, as by the decomposition of any of the soluble salts of lead, by the soluble chlorides of other substances, or by the action of muriatic acid or litharge, or of the same acid on the acetate of lead, &c. To the chloride of lead, however obtained, I add a quantity of the purified liquor, prepared from the ammoniated fluid formed in the manufacture of coal gas, and commonly called gas liquor or gas water, or of the purified liquor obtained in the distillation of putrescent human urine, or of the purified matters resulting from the distillation of bones or other animal matters; and which purified liquors are thus prepared:—The ammoniated liquor obtained during the manufacture of coal gas, and commonly called gas liquor, is to be introduced, after any tarry matter has been carefully separated from it, into a distillatory apparatus connected with a receiver, which should be kept cool; a common iron waggon-shaped boiler connected with a receiver, will answer very well. A quantity of liquor is to be distilled over by a gentle heat, somewhat below boiling, equal to a little more than one-third the quantity of crude gas liquor introduced.

By this treatment, the whole of the volatile salts contained in the gas liquor, will pass over into the receiver; the receiver will contain a moderately-concentrated solution of carbonate of ammonia, mixed with a little hydrosulphate and hydrocyanate of ammonia; should any oil appear in the liquid, it is to be carefully removed or skimmed off. To the liquor must then be added some salt of lead; I prefer to use the carbonate, which should be finely powdered, and added so long as any blackness is produced. The sulphur is thus separated from the liquid, and the sulphuret of lead formed, may be decomposed by dilute nitric acid. When the salt of lead ceases to be coloured by the liquid, the latter should be allowed to stand till clear, and then decanted from the precipitate; and, if not sufficiently colourless, redistilled by a gentle heat, when it will be ready for use. When any solid carbonate of ammonia forms on the upper part or sides of the receiving vessel, it should, after the distillation, be dissolved in the liquid portion collected; or the ammoniacal salt may be procured solid by the repeated distillation at a moderate temperature of the fluid distilled from the crude gas liquor, the salt rising and condensing in the apparatus; this should be desulphurized after the first distillation, in the manner hereinbefore described. The solid salt, mixed with a quantity of animal charcoal, may then be introduced into a proper apparatus and sublimed, by which means the carbonate of ammonia will be obtained very pure; and the solution of this in water will form a fluid fit for use. When wine is employed instead of gas liquor, it should be allowed to stand for a few days in a covered vessel, then introduced into the distillatory apparatus, and about three parts distilled over for every ten parts of wine introduced. The distilled portion will consist chiefly of a solution of carbonate of ammonia; a little carbonate of lead should be mixed with this, to separate any sulphur that may be present, and any oily matter carefully removed. The liquor being decanted and redistilled, will be fit for use. When bones or other solid animal matters are employed, they should be introduced into an iron retort, connected with a series of reservers, as is ordinarily done in the process of distilling these matters for the manufacture of sal-ammoniac and bone-black. The products of the distillation collected will be solid and liquid, consisting of solid carbonate of ammonia, hydrosulphate and hydrocyanate of ammonia, and much oil. The oil should be carefully removed as completely as possible, the liquid portion freed from sulphur, as described in speaking of gas liquor, and redistilled till sufficiently colourless, whilst the solid portion, mixed with animal charcoal, may be sublimed; then dissolved in water, and also freed from sulphur, if necessary, or it may be at once dissolved in water, freed from sulphur by carbonate of lead, and distilled to render it colourless.

Having described the mode of preparing these ammoniacal solutions, I shall now proceed to state how they are to be used in the manufacture of white lead. On the chloride of lead washed, I pour any of these solutions gradually, and with constant stirring, so long as any decomposition takes place, some effervescence occurs from the escape of carbonic acid. I allow the chloride of lead and the liquors to remain together for twenty-four or thirty-six hours, with occasional agitation, in which time the metal decomposition will be completed, the ammonia being converted into a muriate, and the lead into a mixed carbonate and hydrated oxide. This operation should be conducted in broad shallow vessels, to allow of the exposure of considerable surface. After standing, the liquor should be decanted, and the mixed carbonate and hydrated oxide well washed with water, the first washings being added to the decanted liquor. The quantity of the purified gas liquor, or other ammonial solutions necessary for the decomposition of a given weight of chloride of lead, will necessarily vary with the strength of those liquors, but will be easily determined, by trying the strength of the liquors by the quantity of an acid, as the muriatic necessary for their neutralization. This being ascertained, it will be easy to calculate the quantity necessary for a given weight of the chloride of lead. I find that the chloride of lead, obtained from the quantity before stated, of galena and nitric acid, is decomposed by the purified liquor, obtained from about 7466 gallons of crude gas liquor. After the mixed carbonate and oxide of lead, formed as above described, has been well washed, I pass through it, in any convenient apparatus, a current of gaseous carbonic acid, so as to convert it into a perfect carbonate of lead, which is to be washed, dried, and ground, in the manner usually practised, and which is well understood; for the chloride of lead employed in the process just described, sulphate of lead may be substituted, precisely the same processes and operations being required. The results in this case will be sulphate of ammonia and mixed carbonate and hydrated oxide of lead, the latter of which is to be fully carbonated by gaseous

carbonic acid. The sulphate of lead may be formed by the mutual decomposition of acetate of lead, and the sulphate of alumina and potassa or common alum, as is often practised, or by the decomposition of any of the soluble salts of lead, by the alkaline or soluble earthy sulphates or sulphuric acid. In my second process, instead of using the chloride or sulphate of lead, as hereinbefore described, I add gradually, and with frequent agitation, a solution of the nitrate or acetate of lead to the purified ammoniated liquors, so long as any precipitation is produced, whereby are formed perfect carbonate of lead and a solution of nitrate or acetate of ammonia, the carbonate of lead being precipitated; after the carbonate of lead has completely subsided, the supernatant liquor should be decanted, and the carbonate of lead well washed; the first washings being added to the first decanted liquid. The carbonate of lead must then be dried and ground in the usual manner. The precipitation of the carbonate of lead should be conducted in a vessel which can be closed after each addition of the solution of nitrate or acetate of lead, and the mixture then agitated, so as to prevent the escape of much carbonic acid. In my third process, I decompose the chloride or sulphate of lead, by pouring upon it gradually, and with continued stirring, a solution of the sesquir-carbonate or bi-carbonate of ammonia, using such sesquir-carbonate as is prepared for the purposes of commerce; for every 140 parts of chloride of lead, or 152 parts of sulphate of lead, I use a solution of fifty-nine parts sesquir-carbonate of ammonia or seventy-nine parts bi-carbonate of ammonia. Considerable effervescence takes place on the mixture of the chloride or sulphate of lead with sesquir-carbonate or bi-carbonate of ammonia, and there is formed sulphate or muriate of ammonia and perfect carbonate of lead. This process should also be conducted in a vessel that can be closed after each addition of the materials; and during the agitation of the mixture, it will be unnecessary to transmit gaseous carbonic acid through the carbonate of lead formed in this case; as, if properly conducted, the lead will be fully carbonated. There is nothing in these operations, requiring such a particular form or apparatus, as to render its description necessary in the distillatory operations; the stills or boilers may be of iron; the condensers, and all the other utensils required, will be best of lead. Now whereas in these processes, I do not claim the mode of decomposing nitrate of lead by common salt, nor any particular mode of forming chloride or sulphate of lead; nor do I claim the method of converting the mixed carbonate and hydrated oxide of lead into perfect carbonate of lead by gaseous carbonic acid. But I do claim the mode of making nitrate of lead from galena and dilute nitric acid, and also the mode of decomposing the chloride, sulphate, nitrate, or acetate of lead, by the purified gas liquor, or the purified liquor from distilled urine, or the purified matters from distilled bones and other animal substances. I also claim the method of decomposing the sulphate or chloride of lead by a solution of sesquir-carbonate or bi-carbonate of ammonia, whereby the use of gaseous carbonate acid is rendered unnecessary. I do not claim the mode of concentrating the gas liquor by distillation, as that has been done before; but I claim the method of purifying it by distilling it, and separating the sulphur by means of a metallic salt, by which it is rendered fit for the manufacture of carbonate of lead.

STEELE'S PATENT RANGE, AND APPARATUS FOR HEATING WATER.

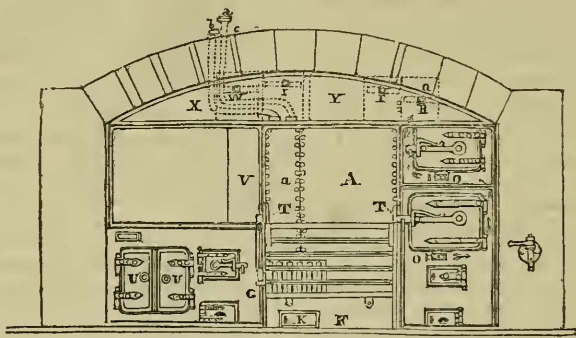
(Abstract of Specification.)

Fig. 1, which is an elevation of our improved range, A, represents a boiler calculated to obviate any defects, and which is made sufficiently high, to admit of water being drawn off from it at any suitable level, for the purposes aforesaid, and to leave space at the top of the boiler, for the generation of steam for culinary purposes. We prefer making this boiler, where circumstances will permit, above two feet more or less, above the level of the bars of the range. In addition to the advantage of this increase of height of the boiler, we also supply the means of cleansing out the inside of the boiler, much more effectually than has hitherto been attained by other means, and are thereby enabled to heat the water at a less expense of fuel. In order to effect this, we proceed to state, that in fig. 3, which is a back view of our improved apparatus, B represents the supply pipe, the orifice of which we carry up within the boiler, to the level of the top of the angle of the front of the boiler, as is shown by the dotted lines, instead of fixing it at the bottom or end, as is commonly done. This is farther illustrated by reference to fig. 4, which is a section of our improved range,

in which figure the pipe, B, is exhibited as ascending to the top of the angle of the boiler; but, in some instances, we carry up this pipe still farther within the boiler, or to any height sufficient to effect the cleansing out of the boiler. In fig. 3, C is an exit pipe, opening at the bottom of the boiler. This pipe is led under the

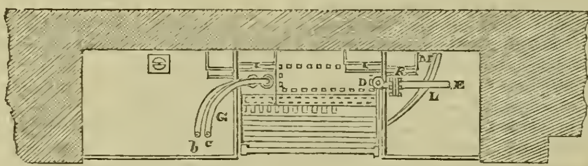
G

Fig. 1.



floor of the kitchen flat, and from thence to the nearest cess-pool, drain, or sewer of the house, at which point, or at any other intermediate place, a stop-cock is attached for opening or shutting this pipe during the cleansing of the boiler, or otherwise; and between this stop-cock and the boiler, we attach branch pipes to the pipe, C, for leading hot water from the boiler to the various places on the ground floor, or wherever it may be wanted. To supply this boiler with water, either for culinary purposes or otherwise, or for cleansing it out, a small auxiliary

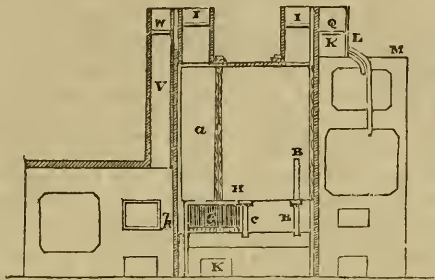
Fig. 2.



cistern is to be placed in any convenient situation, so as to be capable of filling the boiler to within about nine inches from the top, such space being necessary for the generation of steam; the level of the water in this cistern being regulated by a ball-cock in the usual way. This boiler is also provided with a steam-valve, D, and a pipe, E, seen in figs. 2 and 4, for conveying steam to the cooking apparatus, or for heating closets or presses in the usual way. The boiler may be formed of plate-iron or other suitable material; and, in order to make it as efficient as possible for heating water and producing steam, we cause the fire of the kitchen-grate to act on the front, bottom, and back of the boiler; and to cause the fire to act on the bottom and back of the boiler, we shut up the space below the grate with a face plate, F, fig. 1, of iron or other suitable material; so that no cold air can get in behind the boiler, by which also any draught there can only take place by drawing in the heat and flame of the fire through bars, G, seen in figs. 1, 2, 3, and 4, and over their tops at an aperture, H, seen in fig. 3, below the boiler; and the intensity of the heat is regulated by opening or shutting, in a greater or less degree, one or other, or both of dampers, I, placed at the top of the flues, seen in figs. 1, 2, 3, and 4. The face-plate, F, is provided with a door, K, opening with hinges, and a suitable fastening thereto, which is opened as occasion requires, for clearing out the ash-pit below the grate-bars, G, and to facilitate which clearing, these bars, G, are cast in separate pieces, to admit of their being taken out, and thus open a passage to admit of the whole space behind being cleared out. These bars are formed or

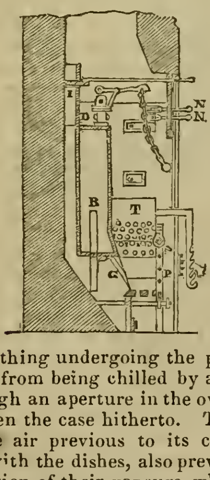
cast with ⊤ ends, and rest upon horizontal bars at each extremity thereof. Both ovens are completely ventilated by means of pipes, L and M, seen in figs. 2 and 3, from the back of each oven, and these are terminated by slide valves, N, at the top of the ovens, as seen in section, fig. 4. To admit a current of fresh air, slide valves,

Fig. 3.



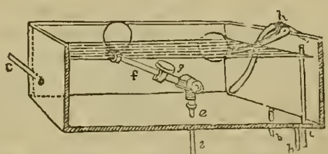
O, are fitted into the front plate, fig. 1; and these open beneath the slip or false bottom of each oven, the space between the two bottoms being divided into two or more compartments; so that the entering air becomes heated in circulating through these divisions under the slip or false bottom, and, rising up through apertures in the bottom, circulates freely through every part of the oven, before it passes off by the ventilating pipes, L and M; and, to effect a more perfect ventilation of the air, the shelves of the ovens are constructed of open or trellis work, as shown in fig. 6, on an enlarged scale, and thereby prevents anything undergoing the process of cooking, from being chilled by air admitted through an aperture in the oven doors, as has been the case hitherto.

Fig. 4.



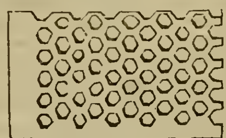
This heating of the air previous to its coming in contact with the dishes, also prevents that condensation of their vapours, which takes place by allowing cold air to act upon them in the usual way, an evil which renders baking or roasting much less perfect than is attainable by our method of ventilating. The ovens are so constructed, that they are heated by the fire of the range passing into their flues at an opening, P, seen in fig. 4; after which the

Fig. 5.



heat circulates around the ovens in the direction of the arrows seen on the front plate of the ovens, fig. 1, and then up a flue, Q, figs. 1 and 3, into the chimney; and, to regulate the draught, this flue is provided with a damper, R, seen in figs. 1, 2, and 3. The bottom and side of the lowest oven are protected from the intensity of the fire by means of safe plates or saddles, S, seen in fig. 4; and the ends or cheeks of the grate are also protected by safe plates, T, seen in figs. 1 and 4. The boiling table or hot plate, is fitted up with

Fig. 6.



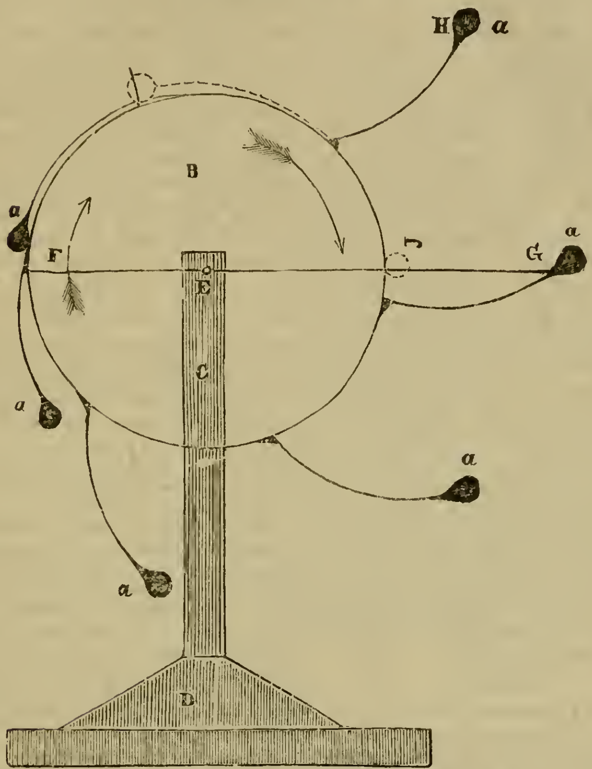
a hot-press, the folding-doors of which are seen at U, fig. 1; and, in order to heat this table, we cause a portion of the flame and smoke, or heat of the fire, to pass into the flues of the table, and to circulate

under the top plate, which is provided with a flue-plate for that purpose, but which is not seen in the drawing; and from thence the flame and smoke pass up a flue, V, seen in figs. 1 and 3, and which flue is provided with a damper, W, seen in the same figures, by the opening or shutting of which, the temperature of the table is regulated. The aperture at which the fire enters the flues of the table, is similar to that already described for the ovens, and seen in fig. 4, at P. The boiling table is also provided with a ventilating door, but which is not seen in the engraving; it is fitted into the cheek-plate and opening behind a face-plate, X, fig. 1, for the purpose of preventing any vapour or burnt smell arising from the cooking, finding its way through the house; and this vapour flies off by the door and escapes behind another fire-plate, Y, above the range-fire into the chimney.

We shall next describe our method of raising the temperature of water for baths and other uses. To the vessel, *a*, the pipe, *b* and *c*, seen in figs. 1, 2, and 5, are attached, and the pipe, *b*, is made to descend within the heating vessel, till within about one and a half inches of the bottom; and the other end of this pipe leads to the reservoir, and opens about an inch above the bottom of the said reservoir, or as far above it as to prevent any sediment which might otherwise descend by that pipe along with the water, and which is placed at a higher level than the baths; and through this pipe the water from the reservoir descends into the heating vessel, to be there heated and forced up again into the reservoir; and the other pipe, *c*, leads from the top of the heating vessel, and terminates at or about six inches above the bottom of the said reservoir, as seen in fig. 5, and by this pipe, hot water ascends up into the reservoir, by the greater gravity of the cold water in the pipe, *b*. In order to take off the water to the baths, or to any other place where wanted, a pipe, *e*, seen in fig. 5, is inserted into the bottom of the reservoir; and, upon the opening of this pipe, there is another pipe, *f*, seen also in fig. 5, fitted by means of a screw or other coupling; this pipe, *f*, turns upon a joint immediately above its coupling, to the pipe, *e*, so that its upper orifice can be moved to any level in the reservoir, and so drain off the water there, at whatever level it may be; and, to effect this rising or falling of the mouth of this pipe, *f*, a float-ball is attached to it, in such a way, as to keep the upper orifice of the pipe about three inches below the surface of the water in the reservoir; and to adjust the buoyancy of this float-ball to the degree of depth required, a weight, *g*, also seen in fig. 5, is attached to the pipe, *f*, so that the depth of the orifice of that pipe, below the surface of the water in the reservoir, can be easily regulated at pleasure, by shifting the weight up or down the pipe, as the case may require. The object of this pipe, *f*, is to run off the hottest portion of the water in the reservoir into the baths, and this can be done only by drawing off near the surface, as the natural tendency of heat is to ascend. Our apparatus being so arranged, hot water is run off from the reservoir, through the pipes, *f* and *e*, immediately on a stop-cock or valve on that pipe being opened, in connexion with the bath or other place, where the water requires to be drawn. In addition to the parts now described, the reservoir is provided with a supply-pipe, *h*, see fig. 5, the orifice of which is led down to the bottom of the reservoir, so as to occasion as little intermixture of the cold water with the hot, as possible. The supply of cold water is regulated by means of a stop-cock and ball on the pipe, *h*, in the usual way, and a waste-pipe, *i*, is placed for clearing out the reservoir, and as an overflow-pipe for carrying off any surplus water, in the event of any derangement of the ball-cock on the supply-pipe, *h*. In order to cleanse this heating vessel, *a*, a pipe, *k*, is attached to it, seen in fig. 3, and having a stop-cock on it, at or near the same point as the cock on the pipe, C; it proceeds along the floor of the kitchen flat, in the same direction as does the cleansing-pipe, C, of the boiler, A; and a little beyond the stop-cock of this pipe, it is joined to the said pipe, C, and which latter pipe (on opening the cock of the pipe, *k*) then serves as a discharge-pipe, for both the boiler and heating vessel, and thereafter communicates with the cess-pool, or the drain, or sewer, as already described, in regard to the boiler, A. It is obvious, however, that the access must be provided for using the stop-cocks at the junction above referred to; and in order to this, an opening must be made in the floor for the purpose, and may be covered with a plate of iron or a stone, fitted into a suitable recess, cut for its reception; or the cleansing water of the heating vessel may be discharged at any other point more convenient. In either case, during the time that the water within the heating vessel is being run off, pure water is allowed to descend into it from the reservoir above, and, falling into it, stirs up all sediment, and thus clears out the heating vessel; and the same process is employed

for the range-boiler, A. In both cases it is necessary that the exit or discharge-pipes should be of greater area than those by which the water runs into the boiler or heating vessels during the cleansing process; otherwise the water cannot be emptied from these vessels fast enough to form a space for the entering water falling into, which would render the attempt at cleansing abortive.

PERPETUAL MOTION.



To the Editor of the Mechanic and Chemist.

Sir,—I had long entertained an idea, like many others, that the tantalizing object, perpetual motion, might one day be accomplished; until somewhat convinced by theory of my error, by which I was so influenced, that the schemes I have devised to effect the accomplishment of the same, are indeed very numerous, one of which may not prove uninteresting to some of your many readers, as for its simplicity, I think it stands unrivalled. If you should think it worth insertion, it might lead some of your intelligent correspondents not to laugh at me, but to make some just comments thereon, which might tend to edify a portion of your readers, myself included.

I am, Sir, your obedient servant,

J. C. S.

Description of Engraving.

B is a wheel, to the circumference of which is attached a series of steel springs, and to the end of each of these is a metal knob, *a*; E is the axis of the wheel, which works in the upright, C; D is the stand. Now as it is evident, that as the

wheel revolves in the direction of the arrows, so will the springs continue to project one after the other in that direction, which, acting as powerful levers, will tend continually to overbalance the opposite side, thereby producing a perpetual motion, if such be possible.

[The weight, H, should have been drawn in the position shown by the dotted line; if the spring were strong enough to lift the weight almost perpendicularly from that point, it would, *a fortiori*, project the ascending weights from the circumference, and thus defeat the desired object. But the fallacy of schemes of this kind is best and most clearly demonstrated by general principles:—Thus, suppose the wheel to turn till F becomes uppermost; if the weight, F, were fixed to the circumference, it would, in its descent to J, exert the same power as if it had descended the perpendicular distance, F J, acting in the manner of a pulley; and the same power would be required to bring it up again to F; but, by the action of the expanding spring obtaining a greater leverage, the velocity of the perpendicular descent of the weight is, and in all such cases necessarily must be, increased; and the power exerted, which can never exceed the whole perpendicular descent, is represented by the line, F G. Now in the ascent of the weight, G, it is evident that more power will be required to raise it from G than from J; and it is not less evident, that the additional power is represented by the line, J G; so that it amounts merely to this:—a force, J G, is gained in the descent, and a resistance, J G, is added to the ascent, therefore no continued motion can result from this combination.—ED.]

GEOGRAPHY OF PLANTS.

THE plants which flourish and thrive in countries remote from each other, offer to the eye of the traveller a series of pictures which, even to an ignorant and unreflecting spectator, is full of a peculiar and fascinating interest, in consequence of the novelty and strangeness of the successive scenes.

Every zone has its peculiar vegetables. At the equator we find the natives of the Spice Islands, the clove and nutmeg trees, pepper and mace. Cinnamon bushes clothe the surface of Ceylon; the odoriferous sandal wood, the ebony tree, the teak tree, the banyan, grow in the East Indies. In the same latitudes in Arabia the Happy, we find balm, frankincense, and myrrh, the coffee tree, and the tamarind. In the thickets to the west of the Caspian Sea, we have the apricot, peach, and walnut. In the same latitude in Spain, Sicily, and Italy, we find the dwarf palm, the cypress, the chestnut, the cork tree; the orange and lemon tree perfume the air with their blossoms; the myrtle and pomegranite grow wild among the rocks. We cross the Alps, and we find the vegetation which belongs to northern Europe, of which England affords an instance. The oak, the beech, and the elm, are natives of Great Britain. As we travel still farther to the north, the forests again change their character. In the northern provinces of the Russian empire, are found forests of various species of firs. In the Orkney Islands, no tree is found but the hazel, which occurs again on the northern shores of the Baltic. As we proceed into colder regions, we still find species which appear to have been made for these situations. The hoary or cold alder makes its appearance north of Stockholm; the sycamore and mountain ash accompany us to the head of the Gulph of Bothnia; and as we leave this, and traverse the Dophrian range, we pass in succession the boundary lines of the spruce fir, the Scotch fir, and those minute shrubs which botanists distinguish as the dwarf birch and dwarf willow. Near to or within the arctic circle, we find wild flowers of great beauty—the mezerium, the yellow and white water lily, and the European globe flower.

We have thus a variety in the laws of vegetable organization, remarkably adapted to the variety of climates; and, by this adaptation, the globe is clothed with vegetation, and peopled with animals from pole to pole. We conceive that we here see the evidence of a wise and benevolent intention, overcoming the varying difficulties, or employing the varying resources of the elements with an inexhaustible fertility of contrivance, a constant tendency to diffuse life and well-being.

With respect to our own country, scarcely one of the plants which occupy our fields and gardens is indigenous. The walnut and the peach come to us from Persia; the apricot from Armenia; from Asia Minor and Syria we have the cherry tree, the fig, the pear, the pomegranite, the olive, the plum, and the mulberry. The vine is not a native of Europe, but is found wild on the shores of the Caspian, in Armenia, and Coromania. The most useful species of plants, the cereal vegetables, are certainly strangers, though their birthplace seems to be an impenetrable secret. The potatoe, which has been so widely diffused over the world in modern times, and has added so much to the resources of

life in modern countries, has been found equally difficult to trace back to its wild condition.* Our fields are covered with herbs from Holland, and roots from Germany; with Flemish farming and Swedish turnips; our hills with forests of the firs of Norway. The chestnut and poplar of the south of Europe adorn our lawns, and before them flourish shrubs and flowers from every clime in profusion. The products which are ingredients in our luxuries, and which we cannot naturalize at home, we raise in our colonies, and man lives in the midst of a rich and varied abundance. And this plenty and variety of material comforts is the companion and the mark of advantages and improvements in social life, of progress in art and science, of activity of thought, of energy of purpose, and of ascendency of character.—*From Whewel's Treatise of Astronomy and General Physics.*

REVIEW.

Guide to Plymouth Breakwater. By J. Claringbull. Devonport: W. Byers; London: J. W. Parker, West Strand.

The importance and manifest advantages of Plymouth Sound as a naval station, have, during the last half century, attracted the attention of the British Government to various plans for protecting vessels stationed there, from the inconvenience and danger occasioned by its exposure to south-easterly and easterly winds. The present stupendous national work was commenced in 1811, upon the plan suggested by Messrs. Rennie and Whidbey. It is an insulated stone pier, across the middle of the Sound, and about 1700 yards in length. Great difficulties have been encountered during the progress of the work. On the night of the 9th of January, 1817, a tremendous hurricane occurred, when the tide rose to an extraordinary height, and such was the violence of the waves, that 200 yards in length, and thirty in width of the upper stratum of the breakwater was carried away, and deposited on the inner slope of the work. This misfortune, though it created some apprehensions for the permanent security of the work, proved the efficacy of the construction, in producing the desired result to the vessels stationed within it. On the night above mentioned, two vessels, anchored without the breakwater, were driven from their moorings and lost; while those anchored within its shelter, sustained no injury. On the night of the 22nd of November, 1824, another storm occurred, which tore up 748 yards of the work, and nearly 200,000 tons of stone, consisting of blocks varying from three to ten tons, were carried away by the violence of the waves, and deposited on the inner side. Other difficulties of a still more formidable nature are now anticipated; an accumulation of mud within the breakwater, appears to be gradually proceeding, threatening, in the course of time, the total destruction of the anchorage. An enemy has also appeared in the shape of a little animal called *saxicava rugosa;* they are first observed adhering to the stones under water. They are something like the common muscle in appearance, but no larger than pins' heads, till they penetrate five or six inches into the stone, when they increase to about half-an-inch in diameter. Immense quantities of limestone are perforated, like a honey-comb, by these destructive animals; and it is supposed that hundreds of tons are destroyed by them every year.

For a variety of interesting particulars and judicious suggestions, we must refer the reader to Mr. Claringbull's excellent little volume. The accuracy of the information it contains is unquestionable; the author being the son of the late Government surveyor of the breakwater, and having had access to all documents concerning

* The potatoe, now so universally cultivated, was originally imported from America, and the first mention of it appears in the works of the great German botanist, Clusius, in 1588, who had received a present of two of the tubers from the governor of Mons in Hainault, who had procured them from Italy. Peter Cusa, in his Chronicle, printed in 1553, mentions that the inhabitants of Quito, in South America, cultivate a tuberous root, which was used as food under the name of *papas*. This, it is affirmed, is the same plant which had been transplanted to Europe, and which Clusius had received from Hainault, and who placed it among his rare plants. The potatoe in several parts of South America is found growing wild, and is supposed to be indigenous to that country. In Chili, the wild specimens are generally found in steep rocky places, where it never could have been cultivated, and where its accidental introduction was impossible. The potatoe was introduced into England by Sir Walter Raleigh in the reign of Queen Elizabeth, who, within a few years subsequent to 1582, made several voyages of adventure and colonization to that part of the New World. As Sir Walter had a large grant of forfeited land in Ireland, which he planted and colonized, there is the greatest reason to suppose that he introduced the plant into that country almost as soon as it was introduced into England.—*Gardeners' Calendar.*

the work. The engineer, the natural philosopher, the seaman, and the curious visiter, will all be amply repaid by the perusal of the "Guide to the Breakwater;" and we recommend it, with unqualified praise, to the notice and patronage which it deserves.

COAL MINES.

THE coal mines of Whitehaven may be considered as the most extraordinary in the known world. They are excavations which have in their structure a considerable resemblance to the gypsum quarries of Paris; and are of such a magnitude and extent, that, in one of them alone, a sum exceeding half-a-million sterling was, in the course of a century, expended by the proprietors. Their principal entrance is by an opening at the bottom of a hill, through a long passage hewn in the rock, leading to the lowest vein of coal. The greatest part of this descent is through spacious galleries, which continually intersect other galleries, all the coal being cut away, with the exception of large pillars, which, where the mine runs to a considerable depth, are nine feet in height, and about thirty-six feet square at the base. Such is the strength there required to support the ponderous roof.

The mines are sunk to the depth of 130 fathoms, and are extended under the sea, to places where there is above them sufficient depth of water for ships of large burden. These are the deepest coal mines which have ever been wrought; and perhaps the mines have not, in any other part of the globe, penetrated to so great a depth beneath the surface of the sea; the very deep mines in Hungary, Peru, and elsewhere, being situated in mountainous countries, where the surface of the earth is elevated to a great height above the level of the sea.

In these mines there are three strata of coal, which lie at a considerable distance, one above the other, and are made to communicate by pits, but the vein is not always continued in the same regularly inclined plane, the miners frequently meeting with hard rock, by which their farther progress is interrupted. At such places there seem to have been breaks in the earth, from the surface downward, one portion appearing to have sunk down, while the adjoining part has preserved its ancient situation. In some of these places the earth has sunk twenty fathoms, and even more, while, in others, the depression has been less than one fathom. These breaks the miners call dykes; and, when they reach one of them, their first care is to discover whether the strata in the adjoining part are higher or lower than in the part where they had been working, or, according to their own phrase, whether the coal be cast down or cast up. In the former case they sink a pit; but, if it be cast up to any considerable height, they are frequently obliged, with great labour and expense, to carry forward a level or long gallery, through the rock, until they again reach the strata of coal.

The total annual consumption of pit coal in England is stated to be 23,669,400 tons. A ton is about a cubic yard; and, taking one yard in thickness as the basis of calculation, it will give 305 yards per square mile of annual supply. And, supposing the coal to extend throughout the whole subsurface of the country, then the whole quantity would be exhausted in about 10,000 years. But recent observations in some of the Staffordshire mines have shown, that where some of them have been worked out, the workmen have only to work lower, and they find stratum below stratum, beyond all conjecture where they will stop. Thus we might furnish all the world for a thousand years with coals without fear of exhaustion.—*Shaw's Nature Displayed.*

MISCELLANEA.

Invention for Propelling Steam-vessels.— On Wednesday last the Lord Mayor made an excursion on the river, to witness the effect of Mr. Taylor's invention for propelling steam-vessels. The little steamer *Jane*, in which his lordship embarked, is the property of Mr. George Blexland, late engineer to the Commercial Steam-packet Company, and has been an object of admiration, on account of her diminutive size, being only a common whaling-boat, to which Mr. B., some months back, applied paddle-wheels, and in which he fixed a steam-engine of rather less than one-horse power. These paddle-wheels, with their cumbrous and weighty appendages, the paddle-boxes, have been removed, so that the little boat is restored to her original form, except the addition of a figure-head and counter-stern. The propeller, which has increased her speed one-third, the power remaining the same, has been introduced, but the steam-engine has not been moved from its original position; a fact that proved to the experimenters the entire applicability of the method to every steam-vessel. Throughout the whole of the trip, the *Jane* performed admirably. She was under the most perfect control, and appeared to be steered much more easily than when encumbered with the paddle-wheels. She moved as if by magic, creating no swell in the water, and was not affected by the hubbub occasioned by the rapid transit of the large steamers.

Resemblance in the Structure and Functions of Animals and Vegetables.—Plants are organized bodies, the ligneous or woody parts of which correspond to the bones of animals, since, like them, they are composed of concentric layers of hardened fibres, and of vessels to be separated by maceration. The pith answers to the brain and spinal marrow, and an apparent nerve runs down the middle of every leaf, sending off branches which ramify over its surface. They have also their vascular system like animals, and most of them a regular respiratory apparatus, corresponding to lungs. That they have likewise secreting organs and excretory vessels, is obvious from the various odours which they exhale. A tree has its cutis, cuticle, and cellular membrane; the leaves consist of an upper and lower surface of fine skin, between which a certain kind of pulpy substance is enclosed, and numerous air-bladders dispersed. Several are profusely covered with downy hair; and, in others, prickles supply the place of teeth. Grasses present a structure similar to what we see in leeches, caterpillars, &c., or, as having their densest part outside, in the lobster; and analogous in composition to the medusa and the soft insect, is the pulpy house-leek and mushroom. When the pith is dried up, the plant ceases to vegetate; it being of the same importance, and analogous in composition to the brain and spinal marrow of animals. In animals, the bile, saliva, and other fluids, are prepared and separated from the blood from the action of particular vessels; and in plants, a variety of juices are produced by similar operations. Some plants are said to throw off more moisture in a given time by perspiration than the human body. This fluid passes off through vessels which open upon the leaves; consequently it is a very extensive surface that is presented for the discharge of superfluous moisture. Plants also perspire, but in a slight degree, through the cuticular pores; and the same occurs in animals, less being thrown off by the skin than by the lungs. In animals, the colour of the skin depends upon the *rete mucosum*—a kind of net-work above the true skin—and the same appears to be the case in plants. Thus we see an obvious resemblance in the general structure and functions of animals and vegetables, differing, of course, in the more perfect and the more simple; yet, whatever deviations are found from the standard of perfection in the one, similar peculiarities occur in the other. The corresponding parts in each are destined to perform the same offices, or to answer the same purposes.

Sleep of Plants.—Towards evening, plants are known to fold up their leaves, and so continue in that state until morning, when they again expand. This presumed sleep of plants has been supposed by some persons to be owing to the absence of the heat of the sun, which causes a drooping of the leaves of vegetables. But plants kept in a hot room, where the heat is uniform day and night, contract their leaves in the same manner as those exposed to the open day. The same is observed in the lightest nights, and also in plants confined in rooms brilliantly illuminated during night. All plants during sleep dispose their leaves so as to give the best protection to the young stems, flowers, and fruits. The leaves of the tamarind fold round the fruit; the leaves of the chickweed and others, which are placed upon the stalk in opposite pairs, rise perpendicularly during night, and join so closely at the top as to conceal the flowers. The flowers of some plants, also, alter their position during the night; some enclosing themselves in their calyces, or shutting, as it is commonly called; and others hanging their heads towards the earth; but all resume their original position in the daytime.

Mountains.—Although the earth at the distance of Venus, or even at the smaller distance of the moon, would appear to be a perfect sphere, yet those bodies, when examined with a telescope, like the earth, exhibit great inequalities. Nevertheless, in such a mass as the earth, the mountains subtract less from its spherical figure, than the roughness on the rind of an orange subtracts from its sphericity. For although few mountains on the earth are four miles high, that elevation is but the 2000th part of the diameter; and the roughnesses on an orange being taken at the 100th part of an inch, and the orange at three inches, those roughnesses are the 300th part of the diameter, and, in proportion, six times greater with reference to the whole orange, than the highest ridge of mountains is with reference to the earth. Such being the case in regard to the ridges of the Himalayas in Thibet, and the Andes in South America, the Alps, the Pyrenees, and the mountains of Scotland and Wales, sink into comparative insignificance.—*Shaw's Nature Displayed.*

Sugar.—The art of refining sugar was discovered by a Venetian in 1503, who is said to have realized 100,000 crowns by the invention. Our ancestors made use of it as it came in juice from the canes, but most commonly used honey in preference.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, September, 23, Rev. Robert Vaughan, on the Crusades, their Origin, History, and Influence. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Sept. 24, Robert H. Schomberg, Esq., on the Customs and Manners of the Aborigines of Guiana. At half-past Eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 23, Quarterly Meeting. At eight o'clock.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Monday, September 21, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

By what means iron nails may be permanently coloured crimson, brown, blue, green, and yellow? G. BLANCHARD.

How to make a good black dye?

ANSWERS TO QUERIES.

To take off instantly a Copy from a Print or Picture.—Make a water of soap and alum, with which wet a cloth or paper; lay it either on a print or picture, and pass it once under a rolling-press, and you will have a very fine copy of whatever you shall have laid it upon.

Blue Ink.—Ferrocyanide of iron, with a little gum-arabic, will, I think, answer his purpose.

To make Essence of Peppermint.—Put any quantity of the fresh herb of common peppermint (mentha piperitæ) into an alembic; add of water as much as will cover it; then let the oil distil into a large cold vessel. This is a translation from the Pharmacopœia.

To Stain the Hair of an Auburn Colour, use muriate of gold.

Water produced by Burning Alcohol.—Let the flame of a spirit-lamp be placed under a vertical pipe, which is connected with a condensing worm. The product of the combustion, when drawn off from the bottom of the worm, is pure water. MANIPULATOR.

Soda-Water Powders.—Take six drachms of carbonate of soda, divide it into twelve equal parts, and put each into a blue paper. Divide five drachms of tartaric acid into twelve equal parts, and put into white paper. Dissolve each in half a tumbler of water; pour one to the other, and drink immediately. W. G. A. H.

French Polishing.— The process of using French polish having been already explained in No. 1.8, Vol. III., of this work, it would be needless for me to make a repetition of the same words; the only difference is, that French polishers use a little linseed oil, by dipping the end of their finger in the oil, and putting it on the linen rag previous to applying the polish. The fault which "Experimental Mechanic" complains of, certainly must be in applying the polish. Perhaps he continues to rub the work after the rag has got dry, which will remove the polish again. This, perhaps, might account for it appearing dull in the middle, while the edges remain polished; the middle being rubbed most, will remove the polish, as I have before stated. The rags used must be quite clean and free from lint. The work also must be very smooth, &c.; but to point out precisely where the fault is, would be impossible, without seeing it applied. And it cannot be expected that a person not accustomed to polishing can, with a first attempt, produce a polish equal to a person that is always at it; for, like many other things, it requires practice to make perfect. W. G. A. H.

TO CORRESPONDENTS.

S. P. *proposes the following query:—"When I look at the sun through a coloured glass at twelve o'clock, it being at this time* nearest *to me during the twenty-four hours, it appears to have a certain diameter; if at about seven or eight o'clock in the evening I again look at it, when it is just at the edge of the horizon, and, consequently, farthest from me, it appears to have a diameter three or four times as large; what is the cause of this, as* all other *objects appear* smaller *in the distance?" Neither optics nor astronomy can positively explain a phenomenon which depends solely upon an operation of the mind. That the sun or moon in the horizon suggests an idea of greater magnitude than the same body in its meridian, is undeniable; but it is also certain, that the real visual diameter is not increased, which may easily be proved, by observing the body through a tube, or by comparing its apparent diameter with an object at any fixed distance from the eye. Since it is clearly proved that the image, formed in the eye by a body in the horizon, is no greater than that formed by the same body in the zenith, it follows that the phenomenon must wholly depend upon a mental error or misapprehension. Various theories have been proposed by different philosophers, to explain the mystery; but most of them are so palpably erroneous, that they are not worth refuting. The theory which is now adopted by most astronomers, is the only one which has hitherto proved unanswerable; but it must still be considered rather as a highly probable conjecture, than as an established fact. It is assumed, that when we view the heavens from an open place, instead of appearing hemispherical, as they would be if formed by bodies of equal distance from the earth, we conceive them to be in a surface much flatter than half a sphere; so that the parts approaching the horizon, appear farther off, in the same manner as the distant parts of a flat ceiling suggest to the mind that they are farther off than the parts immediately over head. This being granted, all is explained; for the idea of magnitude depends upon the idea of distance, and the conceived magnitude must be proportional to the conceived distance.*

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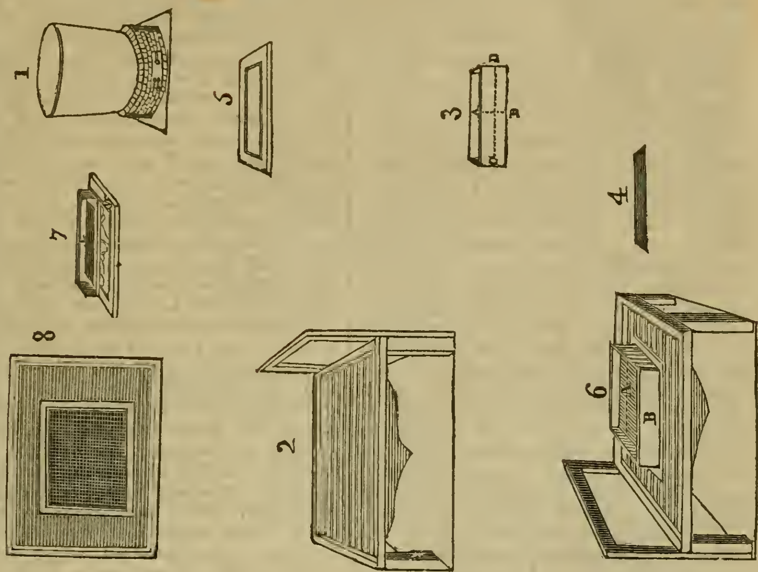
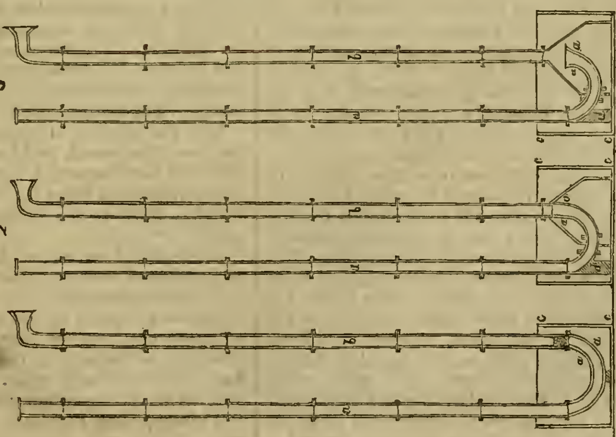
WERTHEIMER'S PATENT APPARATUS FOR PRODUCING RAISED SURFACES IN PAPER.



ADCOCK'S PATENT APPARATUS FOR RAISING WATER FROM MINES.



City Press, 1, Long Lane: Doudney and Scrymgour.

WERTHEIMER'S PATENT FOR PRODUCING ORNAMENTAL RAISED SURFACES IN PAPER.

(See Engraving, front page.)

(Abstract of Specification.)

ALL attempts hitherto to discover a means of imitating the reliefs of sculpture, by stamping or moulding, as I obtain by printing the lines and designs of painting, have proved fruitless. In fact, whether for the decoration of apartments to hangings, mouldings, the imitation of carved furniture and ornaments, or the artificial reproduction of works of art, it would be of great utility to fix the hollows and reliefs of sculpture on thin, flexible, light substances, capable of being stretched, folded, and applied to other bodies. For this purpose sheets of metal, leather, paper, pasteboard, stuffs prepared and united with clammy or gumming substances, have been successively employed. Among the substances, that which is best adapted to the exigencies of the work is unquestionably paper, used here as a generic term for all kinds of paper and pasteboard, whatever it may be composed of, as cotton rags, ligneous substances, &c. From its natural whiteness, its lightness, its flexibility, its cheapness, its solidity, its toughness, the facility with which it can be stretched and fixed with paste, paper, more than other material, would render usual and applicable this kind of veneering in relief; hence paper has been the object of numberless preparations for the purpose alluded to. I do not intend to write a history of all the fabrics of this kind, and will only state, that all the modes, more or less varied, of working the paper, may be ranged in two categories. In the former, the paper is in the state of a sheet; in the latter it is in the state of pulp. When the paper is worked in relief in the form of a sheet, whether it be dry or wet, and the work be done with heat or without, the difficulties that present themselves are insurmountable. In fact, placed between two moulds and forcibly compressed, the paper ought to give, to stretch, to cover the projections and line the depressions of the moulds. But manufactured paper, paper in sheets is, as one may say, non-elastic. The forced extension which is obtained, arises from the rupture of its tissue, whence it follows that all such parts as are angular, and a little projecting, are made thin, torn, cracked. Hence the absolute impossibility of copying, even imperfectly, large reliefs, and of obtaining anything beyond a sort of figuring or goffering (gaufrage). In the state of pulp more or less liquid, paper could not, up to this time, be cast in hollow forms or moulds, but by the addition of various substances. By the aid solely of these admixtures, I obtain smooth surfaces and correct reliefs; but this is an article of consumption which has no analogy with that, the advantages of which I have mentioned. It is a decoration (decor) only, and not paper in relief or embossed, it is breakable, heavy, thick ; it is neither elastic nor flexible ; it cannot be made to cover other bodies like a veneer; in a word, it does not realize any of the conditions of the problem. In the substance used for making the pulp-castings (known by the name of *papier maché*), cuttings of paper are reduced to pulp and mixed with size, Spanish white, powdered slate, and other substances. The pulp of paper, then, is here but a sort of canvass, containing and retaining in mutual connexion sundry materials, the admixture of which forms a mass lighter and less brittle than plaster, but which constitutes only the perfection of works of this kind. I pass over a third mode of employing paper in the fabrication of masks and dolls. The uniting sheets of paper or pasteboard in a mill by means of a cementing substance, has no analogy to the object in question; besides, even in this manufacture, the pasteboard is necessarily united with clammy substances, which are breakable when dry. Thus, then, that manufacturing problem remains unsolved, which consists in fixing the depressions and reliefs of sculpture on a thin flexible body, hard, light, elastic, and that will admit of being fitted and pasted to other bodies, for the purpose either of decorating apartments for hangings, mouldings, or fancy devices, or to imitate valuable carved furniture or ornaments, or to reproduce, at a low price, works of art of every kind.

It is the solution of this problem which has been discovered, and for which I have obtained her Majesty's letters patent. I beg to repeat, in order to distinguish that which is novel in the process more effectually.

First, that I do not employ paper, card, or pasteboard in sheets, except occasionally in an unfinished state.

Secondly, that I do not employ the pulp of paper cuttings, of rags, or any other analogous substance in the state of pulp, firm, and that will admit of being handled, as in the manufacture of dolls.

Thirdly, that I do not mix with the pulp of paper any of the materials employ-

ed in the fabrication of articles of *papier maché* ; and that if I do occasionally make an addition, it is solely with the view of changing the colour or aspect of the work, and by no means to assist in moulding the pulp of paper, from which I obtain the better effects the purer it is.

Fourthly, finally, that I work with the pulp of paper cuttings, rags, or any other fibrous or ligneous substances in a liquid state, and in the same quantity as they are used in common paper-mills. Thus I make paper in relief of all sizes, as common paper is daily made in sheets and pieces with a smooth and plain surface. My process consists, then, in substituting for the wire moulds that are employed in common or mechanical mills, moulds carved in relief or concave. And as the liquid, which holds in suspension the fibrous particles of the diluted pulp, cannot run through the carved moulds as it does through those of wire, I, by a new method, precipitate these particles mechanically and regularly upon the carved surface, and separate them from the liquid ; as I proceed to explain in the following description of the process and apparatus.

Description of the Apparatus used in the Manufacture of Embossed Paper.

In the manufacture of paper without machinery, the pounded rags are diluted to a proper degree in a vat, slightly heated, from which the workman takes, in a form or mould, the quantity of material necessary for the formation of each sheet of paper.

Fig. 1 represents this vat.

Fig. 2 represents a strong wooden table, composed of a certain number of parallel laths or blades, like those of a blind or shade (pesienne), with an interval of some lines between them. Under this table, a sort of apron, or large funnel of wood or zinc, is destined to receive the water that passes between the laths, and to conduct it to a receptacle fixed in the most convenient situation.

Fig. 3, a frame composed of four pieces of wood joined at the ends like a box. Its height measured on the line, A B, is six to eight inches ; the thickness of the board is one inch on two of its sides, and, following the direction of the line, A B, holes are bored from six to nine lines in diameter, and six lines one above another. These holes are stopped by corks, which are easily withdrawn, to suffer the liquid that the frame may contain to escape. There must be a certain number of similar frames varying in length and breadth, according to the size of the moulds ; as the edges of the latter must always exceed, by one inch, at least, the dimensions of these frames.

Fig. 4, sash-frames (chassis) of slight wood, or better of copper, the exterior length and breadth of which should be rather less than the exterior length and breadth of the frame, fig. 3, into which they must be inserted. These sashes are covered with cloth of silk or hair, which makes them represent a very elastic paper mould ; this cloth can be likewise made of any other substance.

Fig. 5, a mould of carved wood, representing inverse the subjects to be worked in paper. These may be made of any material, provided they have sufficient strength to support a pressure frequently repeated between a hard body (the platform of the press) and an elastic body (the counterpart of felt and cloth shearings).

Fig. 6, table on which are represented the mould and the frame, in which the diluted material is to be poured ; A, the mould ; B, the frame.

Fig. 7, section of the same frame ; the line, C D (fig. 3). The letter C marks the chassis or sash, which precipitates the solid matter upon the mould, M. The disengaged water, E, escapes at the orifices, O.

Fig. 8, plan of figs. 2 and 6. To this apparatus I must add the following articles, of which it is needless to give drawings, viz. :—

1st. The ordinary moulds of paper-makers.

2nd. Sponges of different sizes.

3rd. Brushes, hard pencils, scissors, knives, embossing tools of modellers, spatulas of wood, &c.

4th. Felts of different sizes.

5th. Presses of the power of 200,000 to 400,000 pounds, of any construction.

6th. Jugs and vessels of such sizes and forms as may be required.

7th. Shelves or frames to complete the drying of the work in stoves, or by the air, arranged as convenience will admit.

Process of Manufacture.—First Method.

A workman places on the table, fig. 2, the mould required ; on this he places the frame, fig. 3, in the manner shown in fig. 6 ; he then takes out of the vat, fig. 1, by means of a vessel of sufficient capacity, the diluted pulp, with which he fills the frame to about one inch of the edge ; he then stirs it with his hand, that it may spread itself uniformly over the surface of the mould. The only object now is, to precipitate the matter regularly upon this surface, and to make the water which holds it in suspension run off. For this

purpose the workman takes the sash or sieve, No. 4; he presses it down quite horizontally into the frame, as is shown in the section, fig. 7, and by this action carries down all the particles of solid matter; and the water, passing through the distended tissue upon the sieve, is thus disengaged. It is now only necessary to procure its egress, which is done by opening the holes bored in the sides of the frame. When the greater portion of the water has run off out of the frames, what remains is absorbed, by applying to the cloth of the sieve large sponges, which are there compressed, until the stuff has acquired a certain consistence, which is known by the cloth ceasing to adhere to it. The sieve is then removed, and afterwards the frame; and there remains upon the mould a regular layer of paper in process of manufacture, which covers it equally in the hollows and flat parts. With sponges of different sizes I continue to absorb the water, and to press the material chiefly into the hollows; and when satisfied that it touches everywhere, and is sufficiently dried, I prepare to put it to press. I fill the hollows carefully with shearings of cloth (tontures de draps), which are to be pressed in a little, and which are to be left a few lines higher than the flat portions of the mould. It is then placed on the bed of a powerful press, and covered with a layer of felts, the thickness of which must be proportioned to the depth of the carving, and pressed with the whole power of the machine. This operation imparts to the work all the consistence and tenacity requisite. The shearings of cloth are then removed from the cavities with small brushes. Every possible impression may be obtained by this method; you may even have ground patterns (des dessous).

(To be continued.)

ADCOCK'S PATENT FOR RAISING WATER FROM MINES AND OTHER DEEP PLACES.

(See Engraving, front page.)

(Abstract of Specification.)

By the present modes of raising water from mines and other deep places, by pumps and pump-rods, and other mechanical contrivances, the water is raised through a series of pipes, in a compact or solid state; in other words, if the depth through which the water be raised by one pump or one lift, be 100 feet, then the pipes, extending that depth, will be full of water, and the whole column of water in those pipes will be lifted up at one and the same time. A column of water 100 feet deep, presses with a force of about forty-five pounds on each square inch of its base. Hence, if the diameter of the pump-bucket or plunger, be twelve inches, and its area, as a consequence, 113 inches, the weight of water to be lifted by the pump or other mechanical contrivance, at each stroke, will be about 5085 pounds, British avoirdupois weight. In a deep mine, therefore, containing ten such columns or lifts of water, below one another, and acted on at the same time by the same pump-rod, extending down the shaft or pit of the mine, the weight of water to be raised is very great, being 50,850 pounds. Hence, to sustain such weight of water, and to overcome the friction of the water in the pipes, and the *vis inertiæ* to put such columns of water in motion, and to sustain its own weight, the pump-rod must be made of sufficient strength; and the steam-engine, water-wheel, or other prime mover by which the effect is produced, must be of large size and great power. By consequence of this *vis inertiæ*, the friction, and the great weight to be put in motion; and, when steam-engines are employed, the alternate action or reciprocation of the great lever or beam of the engine; the number of feet of effective strokes made per minute, is comparatively small, being generally, in deep mines, from about fifty to eighty feet. To explain this more fully, the whole mass of water in the ten columns, being equal in weight to one column of water of the same diameter, and 1000 feet in depth, may be considered as being lifted in the mass, through a distance of fifty or from that to eighty feet per minute. Now, by my improvements in raising water from mines and other deep places, or from a lower level to a higher, and which improvements are applicable to raising liquids generally, and to other purposes, I do not raise water or other liquids in the mass; nor do I find it necessary to exert a pressure, at one and the same time, of forty-five pounds per square inch, as hereinbefore stated, when the height to which water must be raised is 100 feet; nor do I raise water by pumps and pump-rods, but in the manner now to be described; that is to say—

By the aid of a steam-engine, water-wheel, or other prime mover, I give motion to a fan (such as is used, very commonly, by foundry men, engineers, mill-wrights, and others, to force a current of air into cupolas and other kinds of fur-

naces), or to the piston of a blowing cylinder (such as is used by iron masters and makers of iron to force a current of air into blast furnaces for the reduction of ores), and, by the aid of such fan or blowing cylinder, I condense atmospheric air, that it may have a tendency to escape into the atmosphere when liberated from its confinement, with a velocity due to its pressure. When atmospheric air is condensed to a quarter of a pound pressure per square inch beyond the atmospheric pressure, and is liberated from its confinement, it moves, or has a tendency so to do, at the rate of 173 feet in each second of time; at half-a-pound pressure per square inch, the speed due to the pressure is 245 feet per second; at three-quarters of a pound, 296 feet; at one pound, 340 feet; at a pound and a quarter, 375 feet; at a pound and a half, 410 feet; at a pound and three-quarters, 436 feet; at two pounds, 467 feet; at three pounds, 555 feet; at four pounds, 624 feet; and at other pressures with other velocities or rates of speed, as may be known by reference to, or consulting any of the treatises that have been published on the science of pneumatics. Now, instead of raising water in the mass, as hereinbefore described, by pumps and pump-rods and other mechanical contrivances, I avail myself of the mechanical effects to be obtained from the velocities of the air, as due to the pressures hereinbefore made known, or to any other pressures that circumstances connected with mines in different localities may prove to be desirable. I cause the water which must be raised from the mine, or from a lower level to a higher, to be dispersed and carried up in drops, like drops of rain; but the velocities of these drops upward, in consequence of the velocity of the air, as due to its pressure, as above described, is far greater than the descending velocities of rain; for drops of rain, when not receiving an impulse from winds, can only descend through the atmosphere with a speed of about eight feet in a second, when the diameter of each sphere or drop of rain is the hundredth part of an inch. When the diameter of the drop is the sixteenth part of an inch, the greatest descending velocity through the atmosphere is about seventeen feet in a second; and the velocities in a second through the atmosphere, for drops of rain of other diameters, may be thus stated:—For drops an eighth of an inch diameter, twenty-four feet; for drops three-sixteenths of an inch diameter, thirty feet; and for drops a quarter of an inch diameter, thirty-four feet per second. Whereas the velocity of the air, when allowed to escape from a pipe upward, at one pound pressure per square inch beyond the atmosphere, and without making any deductions for the friction against the sides of the pipe, is about 310 feet in a second. But it should be stated, when the air is commingled with the water that must be carried up by it from a mine, or from a lower level to a higher, its motion to a certain extent is retarded. The velocity of the drops of water, however, upward, by this mode or these modes of raising water from mines and other deep places, is far greater than the velocities at which rain usually falls; as hereinbefore has been described.

Description of Engravings.

In the engravings, figs. 1, 2, and 3, represent three different kinds of apparatus for carrying my aforesaid invention into effect; and in each figure the same letters of reference denote contrivances to accomplish similar objects. The three kinds of apparatus delineated in the engravings, are shown in section; *a a*, *a a*, *a a*, *a a*, represent a pipe made of zinc, iron, or other material, to convey air from the fan or blowing cylinder aforesaid, down the shaft of the mine, or to any other depth from which the water or other liquid must be raised; *b b*, *b b*, *b b*, another pipe, somewhat larger than the other, to convey the air aforesaid, and the water which is carried up by it from the mine or other depth, in drops to the surface of the earth, or to the adit, or to any required height, or place of discharge; *c*, *c*, *c*, *c*, a chamber or reservoir, from which the water or other liquid must be raised. By the rapid revolution of the fan, or the upward and downward motion of the piston in the blowing cylinder by the steam engine, water-wheel, or other prime mover imparting motion to it, atmospheric air of the requisite amount of pressure is made to flow down the pipe, *a a*, *a a*, *a a*, *a a*; and where the pipe turns upwards in the chamber or reservoir, *c*, *c*, *c*, *c*, aforesaid, it comes in contact with the water or other liquid, disperses it into drops and forces it up the pipe, *b b*, *b b*, *b b*, and delivers it at the top. In fig. 1, a series of apertures is represented near the bottom part of the pipe, *b b*, *b b*, *b b*; it is through these apertures that water or other liquid flows into the pipe in a series of jets, and is dispersed and carried up the pipe by the ascending stream of air. In figs. 2 and 3, the pipes, *b b*, *b b*, *b b*, terminate in chambers, compounded in shape of a cone and cylinder, and the cylindrical part of each chamber

near the bottom is perforated with a series of apertures, through which the water or other liquid flows from the reservoir or chamber, *c*, *c*, *c*, *c*; into it. The water ascends above the termination of the air-pipe, *a a*; it is there met by the ascending current or stream of air; it is dispersed into drops, and carried up by it in the manner hereinbefore described. In mines and other deep places where the water may accumulate, and rise to some height in the pit or shaft from the stoppage, either by accident or otherwise, of the steam-engine, water-wheel, or other prime mover, or from other causes, introduce a stop-cock or other contrivance, adapted to the purpose, to regulate the admission of water into the pipe, *b b*, *b b*, *b b*, instead of allowing it to flow freely into it through the apertures herein described. I secure to this stop-cock or other contrivance, a rod of wood or metal sufficiently long to be above the surface of any water that may accumulate in the shaft or pit, and of sufficient strength to enable the workmen to open and shut the aperture of the stop-cock or other contrivance by it. It is essentially necessary that this should be attended to, or otherwise the water or other liquid may accumulate to such a height in the pipes, *a a*, *b b*, as may prevent the passage of the condensed air from the pipe, *a a*, into the pipe, *b b*, and thereby stop the action of the apparatus. For a similar reason, the water or other liquid should never be allowed to stand at a higher level above the bottom of the pipe, *a a*, *a a*, *a a*, *a a*, than the pressure of the condensed air can displace. To effect this, the reservoir, *c*, *c*, *c*, *c*, must be so proportioned to the lower part of the pipe, *b b*, *b b*, *b b*, that whatever number of inches the water or other liquid may descend by the pressure of the air in the one, it will ascend to an equal number of inches in the other, as in the two limbs of a siphon or bent guage.

In other modes of applying my invention in practice, I cause the water or other liquid to flow into the apparatus, in any given time, in direct proportion to the quantity that must be carried up by it in that time; and, in other modes, I cause the air to be dispersed and distributed under a large surface of water in a confined reservoir or chamber, that it may take up the water by adhesion, in the same manner that water is taken up in the formation of steam; excepting that, in the one case, the water is taken up by the air, in the other, by caloric. The water and air commixed, is then allowed to accumulate above the surface of the solid water confined within the reservoir or chamber aforesaid, assimilating in its object to a boiler for the generation of steam, until it attains the same pressure per square inch, as the air contained in the pipe, *a a*. It is then allowed to flow through a pipe, extending above the surface of the water or other liquid in such chamber, into the chamber at the lower part of the pipe, *b b*, *b b*, *b b*, where it meets with, disperses in drops, and carries up, a farther quantity of water, in the manner hereinbefore described.

At the top of the pipe, *b b*, I cause the air and water to be received in a dome, or other appropriate chamber, that the greatest portion of the water may be collected together again in a body, and thence be allowed to flow freely away; the air, and such portion of water still retained by it, are also allowed to escape.

The fan or blowing cylinder, as the one or the other be employed, may be made to receive air from the open atmosphere; or it may be allowed to receive it from the depths of the mine, by means of pipes extending to the required distance. By this mode of operation, pure atmospheric air will descend the pit or shaft of the mine by its gravity, to occupy the space from which the impure air has been withdrawn; and thus the ventilation of the mine or other place may be either wholly or partially effected.

In other modes of raising water by my improvements, as aforesaid, I produce and maintain by any of the mechanical means adapted to the end, a partial vacuum in the pipe, *b b*, *b b*, *b b*; and, instead of having a pipe, *a a*, *a a*, *a a*, *a a*, extending to the surface of the earth, allow air to flow from the mine into it, through other pipes, arranged for that purpose; so that, by the difference of pressure between the air in the mine and that in the pipe, *b b*, the water may be carried up, in drops, in the manner hereinbefore described.

FOUR-WHEEL AND SIX-WHEEL RAILWAY ENGINES.

A CONTROVERSY has lately sprung up amongst engineers, concerning the respective merits of four-wheel and six-wheel engines; and, considering everything connected with this branch of mechanism of the highest importance, not only to the engineer and the amateur mechanic, but, in its ultimate operation, to the entire population of this country, we lay before our readers some of the chief arguments advanced on either side. Mr. Edward Bury, a respectable authority in

estions of this nature, prefers four wheel engines, and gives nine reasons for preferring them to engines on six wheels:

"1stly. The engine on four wheels is less costly than the one on six wheels; therefore, to have the same number of engines, or the same power on a line of railway, less outlay of capital is required.

2ndly. It allows the engine to be got into less space; consequently more compact, firmer, less likely to derangement, and much lighter.

3rdly. Though the engine is lighter, the adhesion is more perfect, from the weight on the driving wheels remaining uniform, however unequal or out of level the rails may be, enabling the maker to equalise the strain and adhesive power at the same time; as it is lighter, there is less power required to take it up the inclines, therefore more available power left to take up the train.

4thly. The engine is safer, as it adapts itself better to the rails, not being so likely to run off the line at curves or crossings.

5thly. It is more economical in the working, as there is less expense of interest and of depreciation; fewer parts in motion, and, consequently, less friction or wear and tear, as there are fewer parts to maintain.

6thly. The engine being more simple in its construction, in addition to the advantage of having fewer parts in motion, those which are more easily got at, therefore much less expense is incurred in those repairs which are common to both plans.

7thly. The buildings, turn-tables, and other costly conveniences necessary for the maintenance and repair of the engines, are not on so large and extensive a scale; as the engine on four wheels occupies much less space than the one on six wheels.

8thly. As there are fewer parts to maintain on the four-wheeled engine, fewer tools, such as lathes, drills, smithies, &c., are required for the repairs of the one engine than the other.

9thly. As the engine is more simple, having fewer parts likely to derangement, there are fewer chances of delays or stoppages during the journeys, or the times of taking the trains."

In reply to the foregoing, we extract the following judicious remarks from a correspondent of the *Railway Times*:—

"Although each manufacturer has his own peculiar arrangement, I am not aware of any essential difference of necessity involved in the distinction between a four-wheeled and a six-wheeled engine, excepting what the name implies, that one has *four wheels* and the other *six*.

A practical example of this may be seen on the Greenwich Railway, among others, where a pair of wheels has been introduced under the fire-box of an engine, which, I am informed, has run much better since the change, although unaltered in every other respect.

The six-wheeled engine does not require more complicated or additional working machinery; therefore, excepting the allowance to be made for the trifling additional friction and weight of one pair of wheels, &c., *Reasons* 2, 5, 6, 8, and 9, must be allowed to fall to the ground.

In answer to *Reason* 3, I think that most engineers will agree with me, that the adhesion is more perfect in the six-wheeled engine, or, at least, equally so. It is the custom, by tightening up the springs, to throw considerably more weight on the driving wheels than on the others, by which arrangement the driving wheels readily spring down and accommodate themselves to any inequality in the rails; and as the additional weight of one pair of wheels bears but a small proportion to the gross weight of an engine, the power lost in moving them is inconsiderable.

It is strange that *Reason* 4 should have found its way to the wrong side of the argument. The additional pair of wheels tends, I conceive, greatly to diminish that lateral rocking motion, so common to railway trains, and the frequent cause of the four-wheeled engine running off at curves and crossings. By allowing a slight play in the brasses, a six-wheeled engine will traverse curvesas easily as, and much more safely than a four-wheeled.

Reasons 1 and 7 alone I shall leave uncontested (although the above arguments will probably weaken their force); and allow me, sir, in reply to them, to offer one or two reasons in favour of a six-wheeled engine.

I believe I am right in stating, that the third pair of wheels under the fire-box, was added at first to equalise the weight on the rails, and to correct the pitching, which was observed to an alarming extent in the engines with four wheels. Any one, who will take the trouble, may see, that while the motion of a six-wheeled engine is comparatively steady, that a four-wheeled engine is attended with constant jumps, and that the slightest obstruction throws the leading wheels up from the rail, on which they fall again with considerable force. This pitching added to the rocking, to which I have alluded, is productive of several very serious results.

1st. The destruction of the permanent

way; for no road, however well laid, can withstand the force of the engine continually leaping upon it, without rapid deterioration. 2nd. The same cause obviously tends to increased wear and tear of the machinery, one of the heaviest expenses attending the working of a railway; and, from the increased liability to derangement, there is much greater chance of the detention of the train on the road. 3rd. There is a still more alarming consequence,—namely, danger to the public. Four-wheeled engines, when moving at high velocities, have been known to jump completely off the rails, and carry the train with them, when no cause could be found for the accident, in the derangement of the rails or engine.

The breaking of an axle in the four-wheeled engine must, almost inevitably, be attended with the overturn of the engine and train, an accident to which a six-wheeled engine is not so liable, from the shocks to the axles not being so great; and which, if it did occur, would not necessarily produce the same frightful results, as a considerable portion of the weight would be supported by the other four wheels.

To the above practical reasons for preferring the six-wheeled engine, I will only add one, derived from the testimony of those who are best qualified to give an opinion. Most of the leading engineers of the day, and especially the Messrs. Stephenson, gentlemen whom all will allow to take the lead in railway experience and skill, prefer the six-wheeled engine, as *safer and better in every respect*."

We again call the attention of engineers to our remarks on railway curves in No. 37, N. S. We not only think, but are quite certain, that much greater security and diminution of friction would be obtained by a proper attention to the construction there described.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, September 30, James Tennant, Esq., on Marbles and Building Stones. Friday, Oct. 2, H. H. B. Paull, Esq., on the Works of Milton, with Illustrations, At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Oct. 1, H. Hersee, Esq., on Elocution. At half-past Eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, September 28, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

What is the best test for lime in water; and how much lime will it take to saturate water? Likewise the best test for carbonic acid gas in a very strong solution of crystal soda, or a solution of crystal soda and lime? SOAP-MAKER.

ANSWERS TO QUERIES.

To Clean Kid Gloves.—The most efficient method I have ever experienced is, first putting on the glove, and then, with a piece of flannel, wipe it over with milk and soap. This will effectually remove all dirt, but not stains, and is unaccompanied with any unpleasant smell.

N. H. RIVERS.

To Polish the Horns of a Buffalo.—The best method is to have them buffed, the same as the comb-makers buff their combs, by lathe or steam power. The cheapest method of mounting them, is the method employed by the white-metal smiths. I have a pair of horns I intend to polish myself. After taking the ruff off with a file, and rendering them tolerably smooth, I scrape them with a piece of steel or knife, ground similar to a carpenter's scraper. A little pumice stone and oil will fetch out the marks of the scraper; I then polish them with oil and rotten-stone, on a piece of wash-leather, and finish them off with the palm of the hand. The hand, especially that of a female, is one of the best substauces that can be used for polishiug. J. CHILD.

TO CORRESPONDENTS.

Mr. Hedgecock.—*We have received a letter for him, which shall be forwarded, if he will send us his address.*

J. B. Smith.—*We have inquired of manufacturers and others, but it does not appear that any method is known to restore velvet when soiled with grease, &c. The spots may be removed by any ordinary process; but the pile cannot be restored after being laid by grease, &c.*

A Correspondent.—*The professors of chemistry at our principal institutions are the following:—*
University of Oxford—C. G. B. Daubeny, M. D.
Cambridge—J. Cummins, M.A., F.R.S.
London—Professor Daniel, F.R.S.
Edinburgh—T. C. Hope, M.D.
Aberdeen—T. Clark, M.D.
St. Andrews—T. Thomson, M.D.
Trinity College, Dublin—F. Barker, M.D.
College of Physicians, Dublin, E. Davy.

A. B.—*The small steamer on the Thames, the "Jane," is moved by Taylor's propeller. It is placed at the stern of the vessel, and acts on the principle of the spiral worm, the paddles being segments thereof.*

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THE

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A MAGAZINE OF THE ARTS AND SCIENCES.

No. 115, NEW SERIES. | SATURDAY, OCT. 17, 1840. PRICE ONE PENNY. | No. 236, OLD SERIES.

WILLIS'S PATENT WEIGHING MACHINE.

Fig. 3.

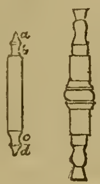
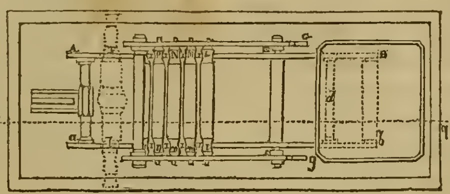


Fig. 1.



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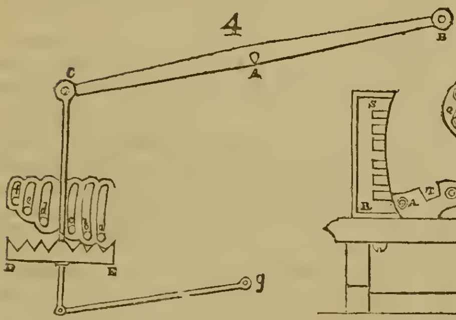

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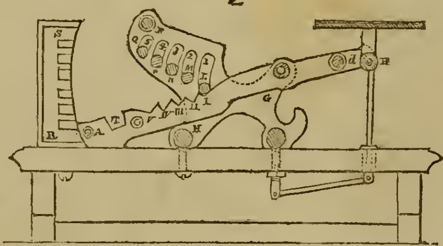
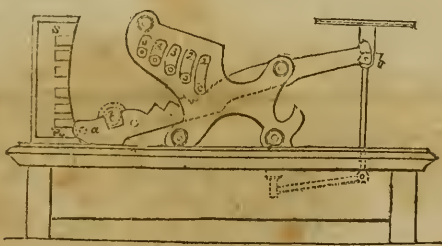


Fig. 2½.



City Press, 1, Long Lane: Doudney and Scrymgour

WILLIS'S PATENT WEIGHING MACHINE.

The inventer of this machine is the Jacksonian Professor of the University of Cambridge; it possesses an advantage over other self-registering weighing machines, in being exempt from the inconvenience of oscillation, which, in most apparatus of this kind, causes much uncertainty and delay. There is, however, one objection to this construction, which may, perhaps, be obviated by the ingenuity of some of our readers: no provision is made for determining the exact weight of bodies which are heavier than one of the series of weights, and lighter than the next in succession; but, with the exception of this defect, we consider it a practically useful machine. The following description is in the inventer's own words, abstracted from his specification:—

Description of Engravings.

"Fig. 1 is a plan of the machine.

Fig. 2, a vertical section made along the line, *k g*, of the plan.

Fig. $2\frac{1}{2}$ is an elevation of the machine. The same letters of reference are applied to the same things in all the figs. A B, *a b*, is a rectangular frame, which constitutes the beam of the balance. This is formed of two similar pieces, A B, *a b*, the form of one of which is seen in fig. 2; these pieces are kept at the proper distance by pillars or other frame-work, as at *c d*; and there is a knife edge at E *e*, fixed to them. The frame of the machine is formed of two parallel plates of a similar form, F G, *f g*, the shape of one of which is seen in fig. 2. These plates are fixed at the proper distance asunder, by means of pillars or other well-known contrivances, as at *h* H, and the whole may be attached to a board or pedestal. The knife edges, E *e*, rest in holes or cups attached to the plates of the frame, and formed in any manner usual to scale-makers, so that the beam of the balance may turn freely thereon. At B *b*, the beam is provided with other knife edges, or suspending pieces of any usual form for the reception of the scale, which is to receive the article to be weighed, and which may be made in any form that is thought best adapted to receive it. The scale-pan, which I prefer, and which is represented in the figures, is that which is usually denominated a Medhurst pan. The weights employed are shown at L *l*, M *m*, N *n*, P *p*, Q *q*. I have, for the sake of simplicity, merely shown five, but a greater or a less number may be used. These weights I prefer to be of a long and narrow shape; and I usually make them of such a form, as may be turned in a lathe for the convenience of manufacture. At each end of the weight (one of which is represented separately at fig. 3), two necks are provided, as at *a b* and *e d*. The plates of the frame have a series of curved openings, 1, 2, 3, 4, 5, fig. 2, the breadths of which are somewhat greater than the diameters of the extremities, *a d*, fig. 3, of the weights; and the weights, when not in use, lie in and rest upon the bottoms of these openings, in the manner shown in the figures; but are prevented from escaping from the frame by the shoulders between the grooves, and by the looped form of the openings in which they lie. On the upper edge of each side of the balance-beam, are formed angular notches, as at I., II., III., IV., V., each pair of which corresponds to one of the weights, and is so placed that, when the beam rises, each pair of opposite notches will be brought in succession under its appropriate weight, and will lift it up by means of the necks already described, *b c*, fig. 3, which are provided for the purpose. The action of the machine will be best shown by an example:—Let the machine be formed to measure the weight of any article in ounces. In this case, the gravity of every separate weight must be so proportioned to the distance of the beam notches from the fulcrum or central knife edges, B *e*, that its mechanical effect upon the scale-pan may equal one ounce. If a body weighing less than an ounce be placed in the scale, the end, B, of the beam will descend, and the opposite extremity rise until the first pair of notches, I., strike against their weight, L *l*; before the beam can move any farther, the weight must be lifted; but as its effect upon the scale is equal to one ounce, and the body is less than an ounce, the beam will remain with its notches in contact. If a body weighing more than one ounce, and less than two, be put into the scale, the first weight will be lifted, and the second pair of notches, II., will be brought into contact with the weight, M *m*, in which position the beam will rest. If a body weighing more than three ounces and less than four, be put into the scale, then the three weights, L *l*, M *m*, N *n*, will be raised one after the other, and the pair of notches, IV., will rest in contact with the fourth weight, P *p*, and so on. An index plate may be connected with the beam in any convenient manner; as, for example, by placing it at the end of the beam at R S, and making its edge concentric with the extremity of the beam; marks

being engraved opposite to the beam in each position, and numbers appended to them to indicate the corresponding weight: then, if any article is placed in the scale, the beam will immediately assume a position corresponding to its weight, by taking up (in the way just described), the required number of loose weights, and will thus show, with great rapidity, the weight of the article in ounces, pounds, or according to any other unit or series of weights that may have been assumed, and to which the separate loose weights have been made equivalent. And it is important to remark, that it will be evident that, according to my invention, the weights, when taken up by the beam, act for the time being, as if each weight were part of the beam itself, there being no swing or action of the weight with respect to the beam. Instead of engraving the weights upon the index plate, the price to be paid for such weight of the article may be engraved; as, for example, postage, if the machine be constructed to weigh letters, or both weight and price may be made to appear; but this I do not claim. I generally adjust the weight of the beam, so that it will require a weight equivalent to the first in the series, to raise it from its lowest position into contact with the first moveable weight, by which means one weight of the series will be saved; but this is not essential.

In the figures, as there are five moveable weights, and the beam is supposed to preponderate, as above described, it is evident, that any weight greater than six ounces, will raise the last weight, Q *q*; and that the weight of any article, if greater than six ounces, cannot be measured. Let a pair of notches, T *t*, be formed in any convenient part of the beam and such a weight be placed in them as will, together with the weight of the beam, exert a mechanical effort equal to six ounces on the scale-pan; then, any weight, greater than six ounces, and less than seven, will raise the beam into its second position, with the notches in contact with the first moveable weight; and, in like manner, the weight of any body less than twelve ounces, will now be measured by the same machine. By providing several of such additional weights, the scale, or range of weights that the machine is capable of measuring, may be extended at pleasure. I would remark that, to insure the perfect action of the balance, the line which joins the centres of motion, B and E, of the scale-pan and beam, should pass through the centres of gravity of every weight, when it lies in the beam notches, as well as through the centre of gravity of the beam itself.

The order in which the weights are raised, is indifferent, provided they be raised in succession; thus, the extreme weight, Q *q*, might be raised first, and so on. Also, the rack may be placed within the beam, so that the beam may act upon the extreme grooves, *a d*, fig. 3, of each weight, and the rack upon the intermediate ones, *c* and *b*; and various other changes may be made in the arrangement and form of the machine, which will readily suggest themselves to scale-makers and mechanics. I do not, therefore, confine myself to the precise form or arrangement shown.

I sometimes make a machine, in a form which is explained in fig. 4; C A B represents a scale-beam, of any usual form, of which A is the centre; and from the extremity, B, is to be suspended a scale-pan or other ordinary receptacle; from the opposite extremity of the beam, C, is suspended another scale pan, of which D E is a side view, and which is furnished with a link, *f g*, below, in the manner of the common Medhurst pan, by which it is prevented from swinging. A series of weights, *a b b d e f*, of the same form as fig. 3, are supported in a rack, attached to the fixed frame of the machine, and the two opposite sides of the suspended scale-pan, D E, have each a series of angular notches, every opposite pair of which lies below one of the weights; so that when the pan, D E, rises from the action of any article in the opposite scale-pan, these notches meet, and take up in succession as many of the weights as are required to counterbalance it, exactly in the same manner as in the machine first described. I have not thought it necessary to show the requisite framing to carry the fulcrum of the beam, and the rack which supports the weights in their proper places. In this form of machine, two or more pans may be placed one above the other, for the purpose of taking up these weights, or the pan which takes up these weights, may be made in various forms; also, the weights may be placed either transversely to the beam (as in the figure) or they may be parallel to it, or otherwise disposed; it being only essential that they shall be placed at a distance, horizontally and vertically, from each other, and properly to be taken in succession by the pan, and, when taken, to retain them from movement, in respect to the pan. I do not claim the principle of causing the scale-beam, or suspended frame of a balance, to raise weights in succession, various

contrivances for that purpose having been used before. But what I claim is, first, the mode of constructing weighing machines, wherein the beam is caused to take up successively a series of weights in such manner that, when taken up, each weight is so held, as to be without swing or action in respect to the beam. Secondly, I claim the mode of constructing weighing machines, whereby a series of weights are successively taken up, each being placed separate, and vertically, and horizontally, distant from each other by a scale, and wherein the weights will be retained, without swing or motion, in respect to the said scale."

POOLE'S PATENT AIR-PADDLES.

(*Abstract of Specification.*)

The invention consists in obtaining power by means of an apparatus, the arrangement of which consists of a series of blades or surfaces, fixed in an oblique direction to an axis, which axis is made to revolve, and, consequently, to carry them round at any velocity required, the atmosphere acting as the point of resistance; whereby I am enabled to obtain a great power, which may be employed for propelling boats, carriages, &c.

First, the point of resistance will be found to be in the atmosphere, and that will be sufficient to produce the motion required. It will be seen hereafter, that the power will be found to be equally available in the water; but it is only when in operation in the atmosphere, that it is perfectly new in its application, and quite different from the others, which require the aid of the ground or water as a point of resistance, to obtain the same result.

To act successfully, the machine or apparatus should be completely surrounded with the atmosphere in which it is working. I will illustrate this by the wheels of a steam-boat, which are alternately plunged in the water and in the air; if they were wholly immersed in water, or wholly immersed in the air, they would not produce any desirable result. My apparatus, on the contrary, should be placed entirely in the air or in the water, to produce its proper effect; but when it is required to act in the water, the form and material of its construction should be regulated accordingly. It will be found as ineffective when working partly in the air and partly in the water, as the wheels of the steam-boat would be, by working in the atmosphere only; the essential principle of this power being wholly immersed in the matter, which acts as the point of resistance. The Archimedes screw acts upon this principle, but the construction of it is very different from this invention.

Again, it turns round on an axis parallel to the line of draft, in a similar manner to the position of the wheels of a steam-boat or a carriage, which makes a right angle with the line of motion.

The essential character of this invention is, the arrangement of a series of flat blades placed in oblique positions to the surfaces, which pass through the axis of the apparatus. These blades or surfaces may be made of metal, wood, or any suitable material; the obliquity of the positions may be varied from 1^0 to 89^0, according to the power of wind you have to act against, whether it is fair or foul, or whether the apparatus is to be used in water. The number of these blades may be varied, from two to twelve, according to the size of the machine; they may be placed two or three together, if required. The size of these blades must depend upon the power required; they may be fixed together by any of the usual means. The axis on which these blades or surfaces are fixed, may be put in motion by a steam-engine or any other power, and the effect will be that the atmosphere, pressed against at the same time by the whole of these blades, will resist; and it forms the opposing medium of the pressure of each surface, the exact points of resistance, according to the extent and position, and, consequently, will become the resisting oblique surface, in relation to the blades which pass through the axis of the apparatus. Each surface being in the same position of obliquity, and pressing with force against the air, will cause a great resistance; the principle of the inclined plane will produce a perpetual pressure of the surfaces, which each of its sides will describe in the air, in a similar way to the Archimedes screw. These blades may be placed two or three together, meeting at the axis of the apparatus, and each surface will furnish an oblique force in relation to the axis, in the same number of degrees as the surfaces themselves, and the resisting air of the combination of the oblique blades. The axis of the machine will be in proportion to the size of the machine, to the number of the blades, and to the greater or less inclination of them, and to the rapidity with which the axis is put in motion.

This apparatus may be applied to move any description of vessel, either floating in the air or in the water. If it is to act in the water, the size of the blades must

be diminished, and the obliquity of them must be increased. This may be also applied for drawing carriages upon the railroads.

ELECTRICAL PHENOMENA.

At a late meeting of the *British Association*, the following paper was read by M. Schonbein on electrical phenomena:—

It is well known to electricians, that in certain electro-chemical decompositions a peculiar odour is evolved, very analogous to that produced by common electric sparks, or by the working of an ordinary electrical machine, in the air. M. Schonbein has undertaken a series of experiments, in order to ascertain the circumstances under which this electro-chemical odour is evolved, the causes which influence its production, and, if possible, the principle to which its appearance is to be attributed. This peculiar odour is evolved at the anode or positive surface, when certain aqueous solutions are decomposed by the passage of a voltaic current. The oxygen gas which is then evolved, has a strong and peculiar smell, which is perfectly similar to that which is always perceived when an electrical machine is worked, or sparks passed through the air. M. Schonbein has observed, that the odour is evolved on the decomposition of water, dilute sulphuric acid, solutions of phosphoric and nitric acid, potassa, and many oxysalts; dilute sulphuric acid yielding it in the greatest quantity; while no smell whatever was perceived on the decomposition of solutions of hydracids, chlorides, bromides, or iodides, which not only did not evolve it themselves, but by their presence, even in small quantity, prevented its evolution from solutions which would otherwise have produced it abundantly. He found, on collecting the oxygen gas evolved at the anode, from a solution capable of evolving the odour, that the odour might be preserved for some time, by enclosing the gas in well-stopped bottles. From the characters possessed by this oxygen, M. Schonbein was led to consider the odour due to the presence of a minute quantity of new and, hitherto, wholly unknown substance, of considerable importance in many natural phenomena; and he has, therefore, named it from its most evident character—ozone. Its properties are briefly as follows:—It is only evolved from solutions containing it, by perfectly clean electrodes of platinum or gold; while charcoal and the more oxidizable metals are unable to cause its appearance. It can only be obtained from a cold solution, as heat prevents its evolution. When a piece of one of the oxidizable metals, such as zinc, tin, iron, mercury, &c., or a few drops of solution of the protochloride of tin, or protosulphate of iron, are placed in a portion of oxygen impregnated with ozone, that peculiar substance is almost instantaneously absorbed, and the oxygen becomes inodorous. When perfectly clean and dry plates of gold or platinum are immersed in oxygen containing ozone, they acquire a negatively electric state of polarity; silver and copper also become thus electric, but in a far less degree than gold or platinum. The plates thus polarized retain their electric powers in air for a considerable time, but rapidly lose it when plunged into hydrogen gas, in which, if retained in a sufficient time, they acquire an opposite state, becoming positively polarized. M. Schonbein then compares these effects with those produced by the odorous matter peculiar to common electric sparks and brushes. When a perfectly clean and dry plate of gold or platinum is exposed to an electric brush issuing from a charged and conducting point, it becomes positively polarized, and the degree of polarity depends on the nature of the point and the time which the plate has been exposed to the influence of the brush issuing from it. He shows that the power is not due to the mere current of electricity escaping from the point, but to some substance produced or evolved by it; because if the point be moistened, the electricity still continues to be given off as a brush, but the power of polarizing the gold or platinum plates is lost. A plate thus charged is perfectly similar in its electrical powers to a plate charged or polarized by immersion in oxygen impregnated with ozone. Heat or exposure to hydrogen, which destroys or inverts the electricity of such a plate, exerts a precisely similar action on plates polarized by exposure to the brush; and, likewise, if the plates are not perfectly clean and dry, it is equally impossible to charge them, either by exposure to the brush, or by immersion in oxygen containing ozone. M. Schonbein supposes that there exists, both in the air and water, a very minute quantity of an electrolyte or compound substance, which, when decomposed by electricity, evolves, as one of its constituents, the peculiar odorous matter called ozone. He observes, that both from its electromotive power, and likewise from its strong affinity for metals, it is evidently similar to chlorine, bromine, and iodine. Its non-appearance, when water is decom-

posed by electrodes of the more oxidizable metals, he attributes to its entering immediately into combination with those metals; and he considers, that when the solution is heated, the affinity of the ozone for metals is so much increased, that it is even able to combine with gold and platinum, thus accounting for its disappearance when heated. By this theory, all the phenomena attendant on its evolution may be easily explained; and it hence becomes very interesting to search for traces of this widely-diffused substance. M. Schonbein considers, that the smell perceived whenever bodies are struck by lightning, is probably due to a small portion of ozone being set free, and relates a case of a church lately struck by lightning, which fell within his own observation, in which the surrounding buildings, to a considerable distance, were filled with a bluish vapour having a peculiar pungent odour. Even in this early stage of the inquiry, it will readily be seen, that many curious and unexplained phenomena might be accounted for, if the existence of the supposed electrolyte be proved. M. Schonbein proposes devoting all his leisure to the prosecution of this inquiry, in the details of which he is at present engaged.

MR. HEDGCOCK'S NEW SYSTEM OF ASTRONOMY.

In justice to the author, we insert his letter without addition or omission; but we must confess, that we see nothing in it to incline us to alter the opinion we at first expressed. In all our reviews, it is our chief endeavour to hold the scales of justice with rigid equity and impartiality, dealing censure or praise according to merit, to the most esteemed friend, as we do to the stranger. All authors are, more or less, enamoured of their productions; and though they may be candidly and honestly seeking for the truth, still they cannot help feeling much disappointment, if they find it in a direction different from that which their theories and surmises had indicated. It is more agreeable to us to concur with an author, than to contradict him; but we have a duty to perform, from which no consideration can dispense us. We do not exactly understand the promised reward of 10,000 acres of land; but although it is situated in the city of London, we advise our readers *not to build upon it.* Even if it really existed, its possession would not be so desirable as many may suppose; for riches and happiness are not always companions—do your duty in that state of life into which it has pleased God to call you; endeavour to deserve the affection of your friends, and the esteem of good men, and you will possess that inestimable blessing—*a contented mind*—which is more valuable than all the acres in the world.

To the Editor of the Mechanic and Chemist.

Sir,—I am extremely obliged by your review of "Multum in Parvo;" but, with respect to the reviewer's opinion, founded, as all our notions have been, upon the Newtonian philosophy, I cannot but forgive the first ebullition of his ideas, as I have found hundreds of the same opinion; and who have invariably been convinced of the correctness of my views. Mark! practical navigators, not theorists. I shall not dwell at present upon the first shot of the enemy, but content myself by proposing for your friend a more perfect analysis of the third plate, and the whole description of both chapters, of 4th and 5th, with the notes therein attached; and if he can find, or any one, a very trifling hint *therein contained*, to obtain the distance, "which I can at any moment produce," I will reward him with shares of lands worth a considerable amount in the city of London, say 10,000 acres. Independently of this distance, the longitude therein contained can be as well ascertained equally at 95,000,000 or 19,000 miles, and all astronomical calculations, as well by the latter as the former; only in the Newtonian system, the whole of the stars ought to be hidden during the time of the earth's progress throughout its orbit, to produce the seasons, &c.; whereas, in the author's proposition, the whole of the stars are the constant proofs of its correctness. We here raise or depress the altitude of the Pole Star for 100 years only a few seconds per annum in any latitude north, and only its horizontal motion since 1820 to 1840 eleven seconds more westward of the true north; and prior to that time, viz., from 1520 to 1820, eleven seconds more eastward per annum, proving a horizontal motion of the earth in a period of 600 years. We are now upon the same position as at the beginning of the Christian era. The year 1200 was remarkable for the great light of Christianity, and building of churches; and about 600 years before, was the commencement of prosperity of the Roman empire; 600 years before was about the time of Solomon's glory—building the Temple, &c.; 600 years before was about the time the Pyramids of Egypt were built, whose

sides should have the same bearing now to the sun at noon, south by west, and Pole Star, north by east, per compass; and which difference from S S W ¼ W at London, being doubled, will produce nearly their longitude east of this meridian. This horizontal motion, *hitherto undiscovered*, contains such a mass of truth, that I wonder how any one, having the least pretensions to scepticism, could have overlooked so important a subject; and 600 years prior to 3600 years, would bring us to the precise time of the great deluge of Noah, as therein stated. Be pleased to put in the method I have sent you on eclipses as early as convenient, and I doubt not you will do me the justice to insert the foregoing, or my ship will be sunk without a shot on my part.

I remain yours, &c.

THOMAS HEDGCOCK, R. N.

7, South Lambeth,
Oct. 5, 1840.

ANDRAUD'S ATMOSPHERIC ENGINE.

THE application of compressed atmospheric air as a substitute for steam, has, for several years past, occupied the attention of the learned, especially in France; and it will be seen by the following extract from a Paris letter, that great progress has been made since we last called the attention of our readers to the subject. It must be recollected, that though the vessel, which is substituted for the boiler in a steam-engine, is required to sustain a much higher pressure than could with prudence be applied to the latter, yet the danger of bursting is no ways increased; for the air-vessel, not being exposed to heat, or any other cause of deterioration, will always retain the same strength it possesses at the time of proving.

Several distinguished engineers and other scientific men attended on Saturday to witness a series of experiments on compressed air, at the late establishment of M. Perrier and Co., at Chaillot. The inventer of the various new and ingenious modes of applying this power, M. Andraud, a gentleman well known in the scientific and literary world, began by exhibiting a small carriage, which was set in motion by compressed air on a small railway laid down for the purpose. This carriage was moved up and down several times at the rate of about twenty-five miles an hour. The air, compressed only to about twenty-five atmospheres, which is little more than one third of the power to which it can be compressed without danger of explosion, is contained in a proof cylinder or reservoir, which supplies the pistons in the same way as for a steam locomotive. M. Andraud states, that two of these cylinders are sufficient for the supply of a locomotive for several miles on a railway; and as air can be compressed almost without expense, wherever there is a stream or even a windmill to work the machinery, fresh charged cylinders can be kept ready at stations and applied to the locomotive, this being the work of only one minute. The improvement in M. Andraud's air locomotive, on all others which have been invented, is in the application of a regulator, by which the air is supplied with unfailing regularity and certainty, and which is under the full control of the engineer, and in the mode of dilating the air by heat, so as to cause great economy. In dilating air it is necessary, for the purposes of locomotion, that it should be done very rapidly, for otherwise the speed cannot be kept up. It cannot be dilated in the cylinder or reservoir without great danger of explosion; and, by the ordinary process, only the external surface of the air immediately exposed to the action of heat, is rapidly dilated; the internal molecules—air being a bad conductor—requiring great time for dilation. M. Andraud gets rid of all this difficulty, by passing the air through a very long spiral tube immersed in boiling lead, and in this way the whole is dilated in the twelfth part of a second; and a reservoir of air thus dilated, gives 5000 strokes of the piston, whereas the same quantity of air undilated gives only 2200. Another of the experiments was with an air-cannon. Balls were thrown from it which, at a distance of 250 yards, broke in the roof of a building, and lodged with great force in a wall, although the air was compressed to only twenty atmospheres. M. Andraud proposes, that batteries in fortified towns shall be worked by compressed air instead of powder; the expense, where there is water power or wind to compress the air, being, according to M. Poncelit, only one-seventy-fifth of that of powder, and, if compressed by a steam-engine, about one-fiftieth. M. Andraud imagines, that field artillery may be worked in the same manner, as the horses, in drawing the guns to the field, would, by the motion of the wheels, fill all the reservoirs necessary for a long battle. The next experiment was on the power of compressed air in raising water, either for the supply of towns or for the draining of

marshes, mines, &c. By a very small apparatus, a column of water was thrown to a height of seventy-five feet.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, October 21, R. H. Semple, Esq., on the Metals. Friday, October 23, Rev. William Vidler, on the Natural History of the Carnivorous Mammalia. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Tuesday, Oct. 20, Election of Officers. At half-past eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Tuesday, October 20, Rev. J. C. Means, on the History of France. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, October 21, Mr. Thomas, on Sulphur. At half-past eight precisely.

QUERIES.

The best and quickest way of dissolving Prussian blue without injuring the colour?

W. R. T.

The best method of preserving animal and vegetable substances.

ANSWERS TO QUERIES.

To Stain Wood of a Mahogany Colour.—Take one pound of log-wood, boil it in four quarts of water; add a double handful of walnut-peeling; boil it up again; take out the chips, and add a pint of the best vinegar, and it will be fit for use.

Another.—Take some linseed oil, and mix with it a little brown umber in powder, and oil of wood; a little red lead may be added. G. T.

Electrical Machine.—I have made an electrical machine out of a turned cylinder of baked wood, covered with shell-lac; the rubbers are of flannel: it answers completely, beyond my expectation.

MANIPULATOR.

1. *What is the best Test for Lime in Water?*—Carbonic acid, which precipitates the lime in the state of a carbonate. It may be done by blowing through a tube into the water. The carbonic acid contained in the air we respire, is quite a sufficient test.

2. *How much Lime will it take to Saturate Water?*—About half-a-pound to twelve pints. Each ounce of the solution contains one grain of lime.

3. *What is the best Test for Carbonic Acid Gas in a very strong Solution of Crystal Soda, or a Solution of Crystal Soda and Lime?*—Diluted sulphuric acid is the best that can be used; the carbonic acid is expelled with an effervescence. Tartaric, nitric, muriatic acids, will do almost as well. The best way is, to put a little of the solution in a wine-glass, and add the acid to it. The same plan will apply to a solution of soda and lime.

W. GROOM.

TO CORRESPONDENTS.

A Correspondent *asks*, "*Whether the heat produced by the sun's rays may not be caused by the extreme velocity with which they move through our atmosphere, and through the material ether with which space is allowed to be filled; as we well know that light and heat can be produced from friction of matter; and the sun's rays being allowed to be material, and the medium through which they pass being allowed to be so also, the supposition does not appear, I think, improbable?*"—*That light is a real existence, is proved by its motion, and its action on bodies; but it has never been discovered to possess the ordinary attributes of matter—gravity, inertia, or extension; neither is its free passage through hard and compact transparent bodies easily reconciled with our notions of* material *existence. Until a more perfect knowledge of the nature and operation of electricity shall have unveiled half the mysteries of nature, we must be content, by diligent inquiry and experiment, to discover and establish isolated facts, where the known laws of nature are inadequate to explain the phenomena. A great deal might be said in support of the theory suggested by our correspondent; but our present object is only to call the attention of our scientific readers to this very interesting subject.*

J. Paterson's *centrifugal escapement will appear when the engravings are ready.*

A Subscriber (Cheltenham) *will see a description of the thermo-barometer in a forthcoming Number. Pure azote should be employed, that gas being perfectly inert.*

This day is published, price, with Tuck and gilt edges, 2s.; or in neat fancy binding, 1s.,

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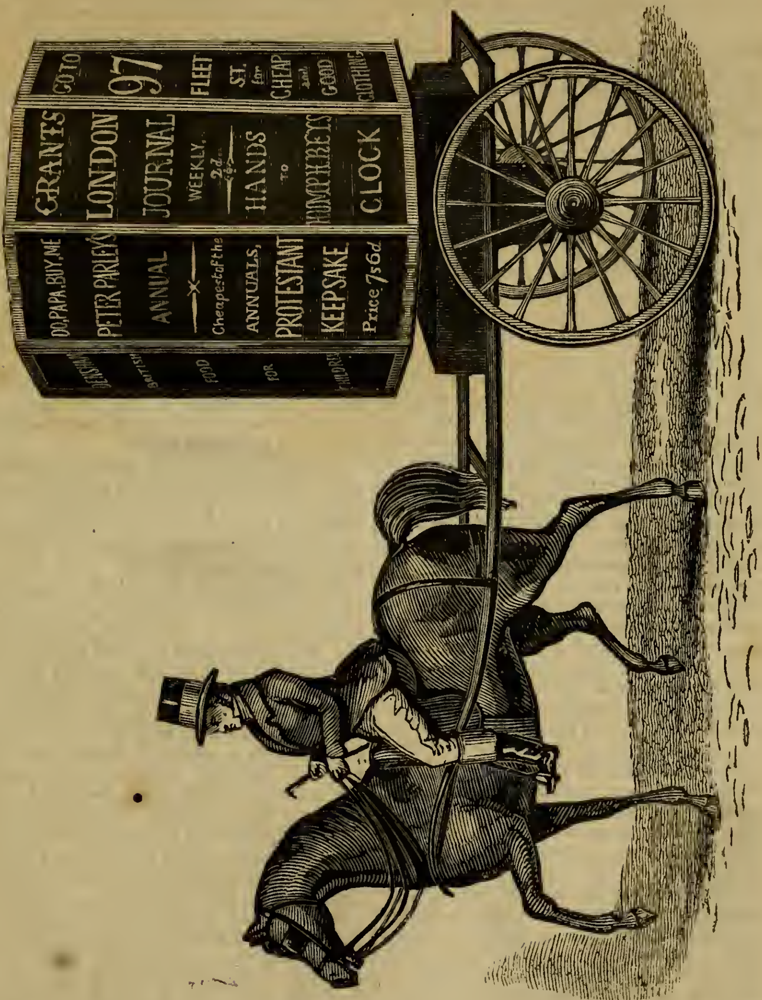
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 116, NEW SERIES. | SATURDAY, OCT. 24, 1840. PRICE ONE PENNY. | No. 237, OLD SERIES.

THE ADVERTISING WHIRLIGIG.



 City Press, 1, Long Lane: Doudney and Scrymgour.

THE ADVERTISING WHIRLIGIG.

Vans and placards being the order of the day, we have this week to notice a great novelty in this mode of advertising, which, we feel assured, will attract the attention of the public. As our artist has carried out the design so well, we have little to say; but that the placards on this van will have a great circulation, as it will be constantly "*going round.*"

DESCRIPTION OF A MUSICAL BOX.

The musical snuff-box, which is, comparatively speaking, of modern invention, is universally admired for the liquid sweetness of its tones, the great range of notes embraced by it, and the rich harmonies resulting from the sounding of several notes simultaneously; but the principle on which this little instrument acts, is not very generally known, therefore we will devote a short space to this subject. Metallic springs, when fixed at one end, and free to vibrate at the other, will yield notes which vary in pitch according to the dimensions of the spring. If two springs be of equal width and thickness, the shorter of the two will yield the higher note: if the length of the two be equal, but the thickness be different, the thicker of the two will yield the higher note. By a judicious management, therefore, of the length, thickness, and width of a series of springs, several octaves may be produced, of which all the semitones may be accurately filled up. Such is the case in a musical snuff-box. On inspecting it, we shall find a series of small metallic springs ranged side by side, in the order of their pitch; the lowest being at one end, and the most acute at the other. By filing these springs, or by loading them with small pieces of metal, attached to their under surfaces, as the case may be, the whole series is accurately attuned, and the means must now be devised for setting them into a state of vibration.

This is effected by means of small pins, which are fixed on the surface of a revolving barrel. The barrel is placed lengthwise, opposite to the ends of the springs, but a small distance from them; so that if projections were not inserted in the barrel, the springs would remain untouched. These projecting pins stand out from the barrel, just far enough to catch against the springs, set them into vibration, and then liberate them again. It might be supposed, that directly the disturbing force is removed, the vibrations of the springs, and the sounds resulting from these vibrations, would cease. But all vibrating bodies make a number of vibrations after the moving force is removed. The pendulum of a clock, the chandelier suspended from a ceiling, &c., are instances of this. But the rapidity of these vibrations during the production of a musical note is so great, as almost to exceed belief, were it not attested by well-conducted experiments. For instance, the note which is called the tenor C, which is the middle C of the pianoforte, is due to a velocity of vibrations of 256 in a second; that is, when a metallic spring, or the wire of a pianoforte, or any other musical instrument, is producing the tenor C, it is vibrating 256 times in a second; and as the pitch of the note becomes more elevated, so does the rapidity of the vibrations increase. It is no wonder, therefore, that we cannot see the vibrations of the springs of the musical snuff-box. The revolving motion of the barrel is effected by similar contrivances to those which produce the motion of the wheels of a watch. A steel spring is coiled up by means of a key which is applied to it; and as its elastic tension causes it to unwind, it sets in motion a ratchet wheel, which acts upon another wheel attached to the barrel, by which the latter is made to revolve, so long as the coiled spring is unwinding itself. The motion of the barrel, then, is wholly due to mechanical arrangements similar to those of a watch.

Having now got the vibrating springs and the revolving barrel, it remains to describe how the pins are arranged on the surface of the barrel, so as to touch those springs, and those only necessary to produce a given tune.

Suppose that the maker had chosen Mozart's air, "Life let us cherish," and wished to arrange it on the barrel in the key of G. The first note is a dotted crotchet on the note B; he therefore places a pin in that circle which is opposite to the spring yielding the note B: this we will call the circle B. The next note is C; but as the first note is a dotted crotchet (equal in duration to three quavers), the second pin must be so placed, that the barrel shall revolve a short distance between the contact of the first and second pins with their respective springs; by which means a proper time will elapse between the sound of the B and of the following C. The next note is B, and another pin is inserted in the circle B; but as the preceding note, C, has only the duration of a quaver, the interval between the second and third notes must be only one-third as long as between the first and second notes; such a position is, therefore, chosen in the cir-

cle B, that that note shall be sounded very quickly after the preceding C. The fourth note is another C, which, on account of the preceding B being also a quaver, is pinned so as to sound after the same length of interval as in the last case. Thus doth he proceed, moving along the barrel to produce difference of pitch, and round the barrel to produce difference of time in the notes produced. In the above air, the B occurs four times; between the striking of the first and second, there is an interval equal to four quavers; between the second and third, fourteen quavers; and between the third and fourth, two quavers. If, therefore, we were to examine the circle of pins which strike the spring B, we should find those four pins at the relative distances of four, fourteen, and two, from one another. By a similar examination, we could find the relative distances of the pins in all the repetitions of the notes G, A, C, and D, in the above examples; but what has been said will be sufficient. The rapidity of the motion of the barrel, and the distances of the pins upon its surface, are so regulated, that a tune is played exactly through, either once or twice, during one revolution of the barrel; else, were not this the case, the pins necessary to produce the final notes of a tune would interfere with those necessary for its commencement. It is generally known, that the greater number of musical snuff-boxes play two tunes each; to effect this, the series of circles of pins belonging to one tune, are interposed between those belonging to the other; that is, the B circle of one is a little on one side of the B circle of the other; and so on with other notes. Now in order that one series of pins may remain inactive, while the other series is striking the requisite springs, the ends of the springs are brought up very narrow, so as to leave a space between them. When the pins of one tune are striking against the springs, the pins of the other pass between the springs without touching them. When a change from one tune to the other is desired, the barrel is, by means of a little mechanism (which is moved by a stud on the outside of the box), shifted a little onwards, in the direction of its length, and to such a distance, that those pins which before acted on the springs, now pass between them; while those, which were before inactive, assume a position in which they can strike the springs. But it must be borne in mind, that the performance is not confined to one note at a time; there is a rich harmonized combination of notes all playing simultaneously, forming tenor and bass, in all their variety and beauty. The person who fixes the pins must, therefore, either be a musician of some skill, or must be furnished with a copy of a sheet of music properly arranged.

E. L.

[The foregoing description is intended merely for the information of the general reader. We are in possession of some valuable practical secrets relating to the manufacture and management of these instruments, and it is our intention shortly to publish them. There are some mistakes in the above communication, which we must take the liberty of rectifying:—The apparatus which regulates the motion of the barrel, is not, as our correspondent states, on the principle of a watch; it is a worm and fly, which may easily be seen and understood. The pins do not follow each other upon the same circle as he describes, but each successive note of the same tone is inserted in a different circle from the preceding one, whenever, as in the above example, they recur at a less interval than about one-fiftieth of a revolution of a small barrel, in the highest part of the scale, and one-fifteenth in the bass. If the pins were placed, as our correspondent describes, the springs would fall from one pin on to another, without producing any musical sound. Even in the small snuff-boxes, eight or ten springs tuned to the same note, are required for the execution of passages in which the same note is repeated in rapid succession.—ED.]

LONDON JOURNEYMEN'S TRADES' HALL.

THE Editor of the "Mechanic and Chemist," with his usual kindness, will aid the cause of temperance among London operatives, by giving publicity to a few words to the *working men of London.*

The absence of a Trades' Hall in London has created an evil which painfully affects your reputation, and retards your welfare—the *public-house meeting!*

Drunkenness, ignorance, want, and misery, are its demoralizing effects in individuals; and in societies, interruption of business, destruction of deliberative judgment, and a waste of funds;—a combined host against the rights of labour!

It is time to abolish this evil—you are equal to this great work. It is never too late to erect a Trades' Hall, to present in the metropolis a *practical* "Mechanics' Institution," on a magnificent scale; the noblest exhibition of your wisdom, pru-

dence, and energy:—the trades of London under one roof—a mighty pillar of strength against oppression!

The morality of a Trades' Hall justifies its immediate establishment by the united operatives of London. What is its expense among you, but as a drop of water in the ocean? Do you love economy? Do you attach any importance to the intellectual struggle for your social and political improvement? Do you enjoy innocent amusements, the festive scenes which mutualize your hearts to one another? Show it by a Trades' Hall of your own! The moral influence of its interior will increase your political importance.

In your several trades, then, discuss seriously the practicability of such an erection; by shares at 1*l.* each, you may easily dignify London with a Trades' Hall; you have union, determination, and judgment, to carry out this important project.

We exhort you to consider the position you will take in this important matter, your prompt decision in its favour is highly essential:—an extensive source of moral and social improvement hangs on the declaration of your will.

London claims a Trades' Hall! Brethren! shall it now be built?

Wm. Farren, Sec.

Trades' Hall Office, 16, Old Bailey,
October 14, 1840.

[That a considerable portion of the working population of this country is in a state of lamentable uneasiness and distress, is, unhappily, too apparent to be denied; and, considering the moral influence of instruction and the more direct advantages derived from temperance and economy, to rank among the most certain and efficacious remedies which existing circumstances will allow, we recommend the working men of the metropolis to respond to the call, and, by their united efforts, to carry into effect the project of erecting a Trades' Hall: but while we tender this advice, we again warn them of the dangers which always attend political broils. We do not wish to contract the bounds of their knowledge, but rather to extend them, so that they may not become the victims of designing demagogues. If men would but calmly look at past and present events, they would perceive that every nation upon earth is continually approximating towards a state of equality with the rest—not political or military equality, but equality of commercial prosperity, popular instruction, and civil institutions, founded upon principles of equity and justice to all. There are, indeed, some exceptions, where this progress is arrested by peculiar local circumstances; Ireland is a striking example of the ruinous effects of the misguided energies of a people. If that unhappy country could be delivered from the influence of those elements of discord and perturbation, which destroy all confidence, and dry up every source of prosperity; if manufactures were established, adapted to the capacity of the ill-instructed population, it would soon be found that their habits of extreme frugality would enable them to live upon very low wages, and produce articles which would be bought in richer countries—thus laying the foundation of commercial prosperity. From labourers would then spring up artists; from artists would arise masters, and masters would become merchants; and when the overflowing of richer nations had produced an equilibrium of wealth, a reciprocal circulation of commerce would ensue, regulated by the respective produce and wants of the trading countries. There are, however, certain natural advantages which one country possesses over another; and the country we live in is happily distinguished, above all others, by its advantageous geographical position; protected by the sea at every point from hostile invasion; by its highly productive and fertile soil; and, not least, by its inexhaustible treasures in the finest coals in the world. Yet, notwithstanding these and other advantages, distress and misery prevail among great numbers of the working classes, and no remedy is discovered. One cause is, undoubtedly, the transition from manual labour to machinery; but time will regulate the supply of labour to the exigence of the new system: many other causes of distress may be discovered or conjectured, and various modes of relief suggested; but we want that sound practical remedy, which must be sought in conjunction with experienced practical men, and the sufferers themselves. Let, then, a Trades' Hall be erected in London, where the journeymen of the metropolis may assemble and discuss their interests, negotiate with their employers, establish salutary bye-laws, and, above all, facilitate the means of obtaining useful instruction; but let them beware of political quack spouters; there is not one, from Smithfield to the Bull-ring, that possesses either wisdom or virtue to give good advice; they constantly seek to render men blind to their real interests, and entice them to the pursuit of phantoms and cacodemons. One says, "Let the Bank resume the issue of paper currency; that will raise the prices of commodities, and also increase the

amount of wages." Another says, "Abolish the Corn Laws; that will lower the prices of commodities and the rates of wages." Another recommends that a general election for members of Parliament should take place every year, and everybody become voters. Others have actually advised, that all the workmen in the kingdom should leave their occupations for a whole month together, for the purpose of injuring the general trade of the country, and their employers in particular. Another numerous class insist upon the abolition of Christian religion, and the destruction of all private property, with no punishment to restrain crime, and no reward to stimulate merit; and these are not more wicked than those who recommend and practise the burning of hay-stacks, and setting houses on fire. Englishmen! how long will you be duped by such sorry doctors?—Ed.]

A VISIT TO A POT MANUFACTORY.

No. I.

One fine morning in July, my companion proposed a visit to the Potteries to see the process of making pots; I had been there several times, but to gratify his wish I agreed, and accordingly, after breakfast, off we started. The morning was fine, and a delightful hour's walk brought us to that region of smoke—the Potteries. A person may know he is near the Potteries, by the large conical buildings, called *hovels* (which surround the ovens—places where the articles are baked or *fired*), which are continually (or nearly so when trade is brisk) vomiting forth dense clouds of thick black smoke.

After passing along several streets, we arrived at the manufactory we proposed visiting. We engaged the bailiff or foreman as our guide. It is but justice to remark, that the manufacturers, together with their bailiffs or foremen, are a very obliging people. I have tried them several times, and I always found them ready at any time to oblige.

The preparing of the clay is, of course, the first step. The chief ingredients used in making all sorts of pots, are flint and clay. The first of these is called by chemists silica, the latter alumina. The clay, called by potters *ball clay*, is brought to them from Dorsetshire and Devonshire, by the canal. Part of the flint is manufactured at the various water-mills which surround the neighbourhood, and is brought to the Potteries in large white barrels, placed upon wheels, and drawn by horses. Some manufacturers work their flint-mills with a steam-engine, and prepare their flint on the manufactory. Another sort of clay, found in Cornwall, called *china clay*, is much used in the manufacture of finer sorts of pots; besides these, there are several other substances used in the composition of different kinds of pottery.

The clay before mentioned is called *ball clay*, from its being in balls or lumps; it is broke in pieces and put into a trough, called the *rough pot*; here water is poured upon it, and the whole is agitated until it is brought to the consistence of cream. This operation is called *blunging*. This mixture is poured into a large cistern through a sieve; here the flint is mixed with it. The clay and flint should be of a certain specific gravity previous to being mixed. When a pint measure of clay weighs twenty-four ounces, and one of flint thirty-two ounces, it is then held to be of the proper consistence for mixing. The exact proportion in which the flint and clay are mixed, cannot be given, as each manufacturer has his own receipt, which, considering it the best, he tries to keep secret. The following are mentioned by writers on the art of potting, as receipts for the composition of the clay:—

Fourteen measures of flint, added to eighteen measures of clay.

	No. 1.	No. 2.
Porcelain clay ..	100 parts	100 parts
Flint	9	9
Gypsum........	4	5
Broken porcelain	9	8

The last two receipts are for the composition of finer sorts of pottery.

This mixture of clay and flint in a fluid state is called *slip*, and, after again passing through the sieve, is mixed with the pieces of clay cut of the different sorts of ware by the turner (whom we shall mention in his proper place) and others, called *shavings*. These shavings, it must be understood, are all of the same composition as the mixture into which they are put. This mixture is again sifted, after which it is pumped or laded into a sort of trough, formed of fire bricks, called the *slip-kiln*. A fire is placed at one end, and the kiln is heated by flues passing under its whole length. In order to have the kiln heated equally in all its parts, the floor should decrease in thickness from the fire to the other end. Here the fluid is made to boil, and the mass is frequently stirred, in order that one part may not become hard, while the other remains soft. Clay is a

bad conductor of heat, and were it not repeatedly stirred, that part in contact with the bricks would become very hard, while the upper parts would remain in a fluid state. Besides, flint is specifically heavier than clay; therefore, were it not frequently agitated, the flint would sink to the bottom, and thereby render the composition

Fig. 1.

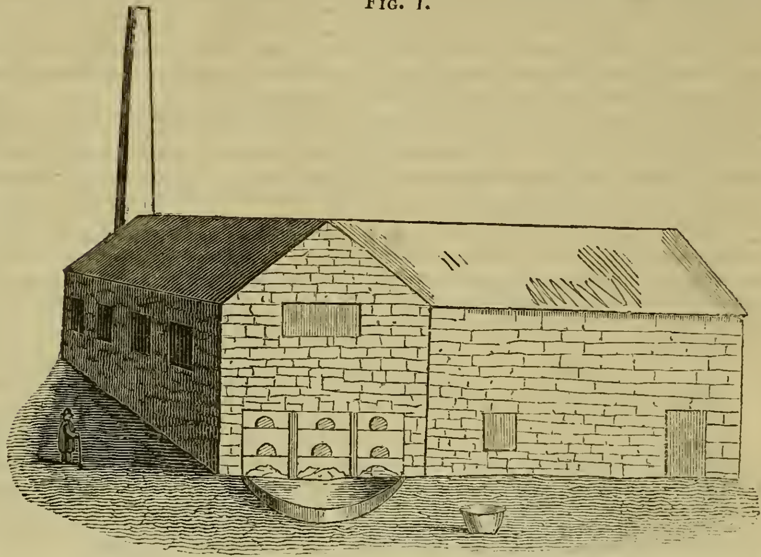
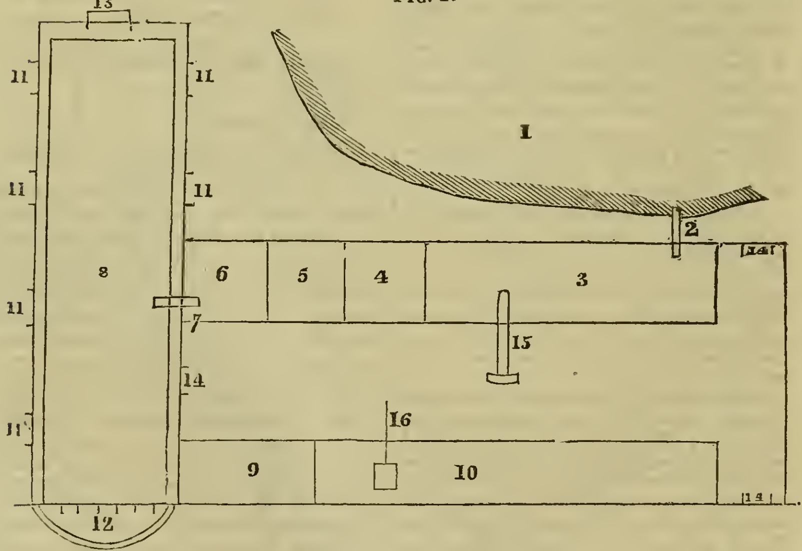


Fig. 2.



unequal. After a considerable portion of its watery particles have been evaporated, it is removed from the slip-kiln, and placed upon large stone flags, called the *beating-board.* Here it is well tempered, by being beaten with large wooden hammers; it is

next cut into pieces with a sort of spade, called a *paddle*, and these pieces are thrown upon the mass with all the strength of the workmen. This laborious operation is continued for a considerable length of time, its object being to expel the air bubbles with which the clay has been filled during the process of evaporation, and to bring the mass into as perfect a state of solidity as possible. It is then left for a few days; for, by letting it rest awhile, it becomes more intimately united than can ever be effected by mechanical means.

The persons who perform these operations are called slip-makers, and the place in which they are performed is called the slip-house, the first place we visited.

In our next we will proceed to the formation of the utensils by the thrower, &c.

Figs. 1 and 2 represent an elevation and a ground plan of a slip-house; 1 (fig. 2), a pool of water; 2, a trough for conveying the water into the rough-pot; 3, the rough-pot; 4, 5, 6, sifting tubs; 7, a trough for conveying the slip on the slip-kiln; 8, the slip-kiln; 9, the flint-ark; 10, the beating-board; 11, 11, 11, 11, 11, 11, are apertures for the escape of the vapour which rises from the slip during evaporation; 12, fire-places; 13, the chimney; 14, 14, 14, doors; 15, a blunger, used in agitating the clay in the rough-pot; 16, a paddle.

HOLDSWORTH'S PATENT PROCESS FOR PRESERVING WOOD FROM DECAY.

(Abstract of Specification.)

The object of this invention is to preserve wood or timber from decay, by immersing it in certain liquids, having the following properties—namely, of receiving a temperature under common atmospheric pressure, capable of charring or searing the surface of wood exposed to their action, and of concreting or hardening more or less by subsequent cooling, so as to remain in those pores into which they have previously entered, as well as to cover the surface of the wood, and thus preserve it from the injurious effects of air and moisture.

The substances that may be employed for this purpose, are, first, natural bitumen, solid or liquid, such as asphaltum or petrolium. Second, the tarry matter produced in the distillation of coal, whether such matter is in its usual state of liquidity, or in that of its products, when it has been subsequently inspissated. Third, common or wood-tar, as well as the products into which it is converted by distillation—namely, common pitch and essential oil of tar. Fourth, turpentine and the products into which it is converted by distillation—namely, oil of turpentine and common resin. Fifth, tallow and other fixed oils or fats of animal or vegetable origin. All the above substances, when at their respective boiling temperatures, are much hotter than boiling water, and therefore any one of them used by itself for a sufficient length of time, might produce on wood, immersed in it when boiling, the searing or charring, which is one of the effects contemplated by this my invention. But as some of them are of too thick a consistence when melted, and as others (being liquid at common temperatures) will not concrete sufficiently in the pores of wood, I find it advantageous to mix them in various suitable proportions. That mixture which I have found to answer my purpose best, is composed in the following manner: I put into an iron pan or suitable vessel, one gallon, or any number of gallons, of wood-tar, and dissolve therein, by the application of a gentle heat, common, that is, wood-pitch, in the proportion of two pounds to every gallon of tar. I then add tallow, in the proportion of two pounds to every gallon of tar; and when this has likewise been melted and well mixed, I add coal-tar, in the proportion of half-a-gallon for every gallon of wood-tar. The above mixture may be made, either in the same vessels as are used for the subsequent process, or in a separate one, and when local circumstances will permit, I prefer to make the mixture in one vessel, and to apply it to the wood in another. The shape of the former of these vessels is immaterial, provided there is a fire-place, by means of which a moderate degree of heat can be given to the mixture contained in such vessel. The latter vessel, being that in which the wood is to be placed, is most convenient, if made of a quadrangular form, the proportions of which will depend on the size and shape of the timber to be operated on. It ought to have bars placed inside, an inch or two above the bottom, for the timber to rest on. It should have a convenient fire-place and a covering with an opening, wide enough to allow the timber to be readily put in and taken out, and should likewise have an ascending pipe or pipes, for the purpose of conveying away the inflammable vapour which rises from the mixture or liquid when heated; in order to diminish, as much as may be, the risk of fire, as well as for the purpose of condensing

and collecting (if advisable) such vapour or essential oil.

The timber, which I prefer to be previously in a seasoned or dry state, is to be brought to the form in which it is intended to be employed, is to be arranged on the bars within the boiler, and the liquid mixture above described, if made in a separate vessel, ls then to be poured in ; the fire is thus to be urged as quickly as consistent with prudence, and it will be found, as the heat of the liquid increases, that bubbles arise from the immersed timber ; so long as the temperature is less than that of boiling water, such bubbles will be little else than common air ; but as the temperature increases, the moisture contained in all timber, even in that which has been seasoned, will be converted into steam or vapour, and will thus not only itself escape out of the timber, but will also drive out much air, and thus allow the preserving moisture to penetrate the deeper. The use to which the timber is afterwards to be applied, as well as its thickness, regulates the temperature of the mixture, and the length of time during which the timber is to remain immersed ; no specific direction, therefore, can be given applicable to all cases ; but, as a general rule, it may be observed, that those pieces which are required to be flexible (such as the planks for ships' sides), require a temperature ranging from 212° to 220°, and generally a shorter time for immersion than those pieces of which the frame of a ship is composed, which require the mixture to be raised to its boiling point.

The wood, when taken out of the hot liquid, should be placed in a warm stove, to drain more or less, according to its intended use, and may then either be employed while still warm, or may be kept until the liquid has hardened on its surface.

George Cruikshank's Earliest Studies.—The gallery in which George first studied his art, was the tap-room of a low public house, in one of the dark, dirty, narrow lanes which branch off from one of the great thoroughfares towards the Thames. And where could he have found a more fitting place? Where could he have met with more appropriate characters? for the house was frequented, to the exclusion of everybody else, by Irish coalheavers, hodmen, dustmen, scavengers, and so forth. It was just the place in which to witness the lowest of low life in all its grotesqueness and drollery. And here I may remark, that it was George's etchings illustrative of low life in "Mornings at Bow Street" and "Life in London," that first brought him into general notice.—*Portraits of Public Characters, by the Author of "Random Recollections."*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, October 28, R. H. Semple, Esq., on the Metals. Friday, October 30, Rev. William Vidler, on the Natural History of the Carnivorous Mammalia. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Oct. 29, S. Preston, Esq., on Pneumatics. At half-past eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Tuesday, October 27, Rev. J. C. Means, on the History of France. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, October 28, Mr. Hathway, on Water and its Elements. At half-past eight precisely.

QUERIES.

1. A description of the different pipes in hand organs with their dimensions, also a scale for making them? 2. How to make Pyropherous?

R. P. G.

What is the specific gravity of cast iron when it is in a state of fusion and the manner of finding it? How to turn a cube in a lathe?

E. Ledger.

TO CORRESPONDENTS.

Mr. J. Knowles *will find a letter addressed to him at our office.*

W. Foster.—*We shall be very glad to see the book upon algebra ; it has not been delivered.*

H. W. M.—*The process said to have been discovered for destroying letters in a short time after they are written, is, we hope, and believe, still in the land of Utopia ; should it be accomplished, we should consider it the duty of all who hold any communion with the public, to expose the fraud, and endeavour to devise a means for frustrating its object. Our correspondent may rest assured that the "Mechanic" will never wilfully publish anything injurious in its tendency ; and if he refers to our observations on the process of destroying letters, he will find that we were very far from encouraging the invention.*

Andi.—*The nitrate of silver is silver dissolved in nitric acid ; gold is dissolved in nitro-muriatic acid ; comp. nitric acid,* 2 ; *muriatic acid,* 1.

G. S. I.—*The substances he mentions, do not possess the properties attributed to them by some persons ; it is a superstitious notion, entirely unfounded in truth.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

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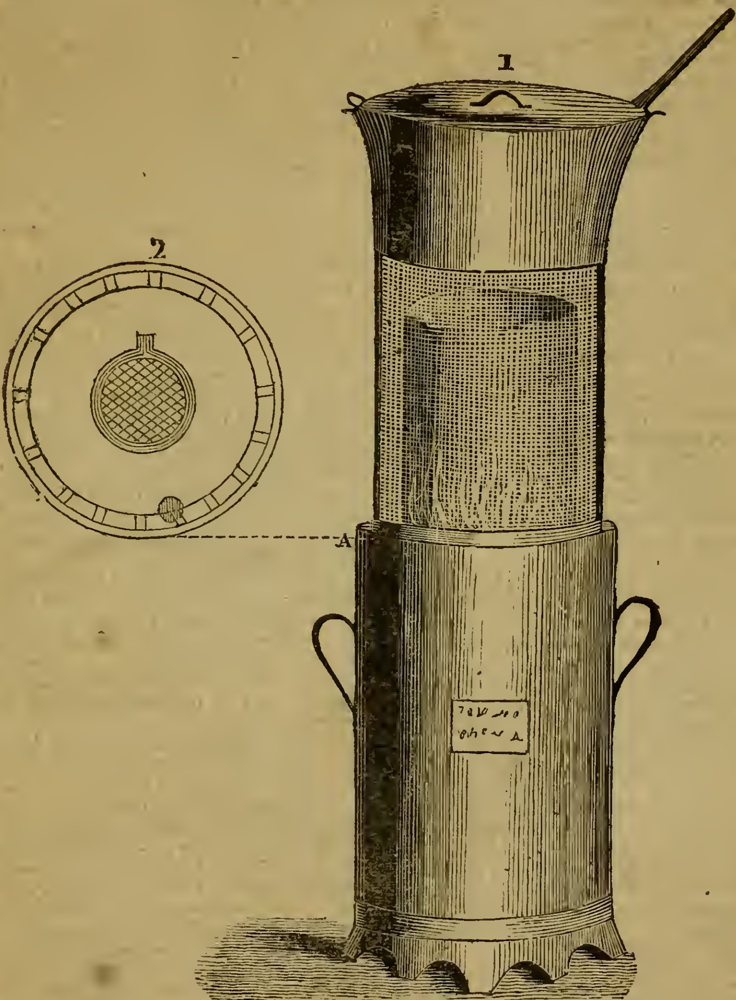
PIESSE'S AEROSTATIC COOKING LAMP.



City Press, 1, Long Lane: Doudney and Scrymgour

PIESSE'S AEROSTATIC COOKING LAMP.

(See Engraving, front page.)

The present mode of heating liquids (water, coffee, &c.) in a balloon is very imperfect, requiring cumbersome apparatus, which gives great trouble to put in operation. It is accomplished by pouring water on unslacked lime in an appropriate vessel; a stoneware bottle, or any utensil made to contain liquids, is then buried in the lime. The heat evolved from the water on its passing from the liquid to the solid state in its union with the lime, is absorbed by the coffee, &c., and thus it becomes hot. Every operation requires a fresh portion of lime and water. When Mr. Green took his memorable trip to Nassau, one of his fellow-travellers, in emptying out the slacked lime, let fall one of the most important parts of this apparatus into the sea; and thus these gentlemen, who were *up* all night, and sitting in a damp atmosphere at a temperature below freezing, were prematurely debarred from taking anything hot to warm their nearly-frozen noses.

Description of Engraving.

Fig. 1 represents an apparatus to remedy these evils, and to obtain a heat sufficient even to boil a potatoe, &c.—a great desideratum in a protracted voyage; for instance, the anticipated one across the Atlantic. It consists simply of an argand lamp, trimmed with alcohol or methylene (i. e. pyroxlic spirit); the latter would be preferred on account of its cheapness), surmounted with a wire gauze, such as envelops the flame in the Davy lamp; on the top of this is a ring to support a saucepan, &c.

Fig. 2 is a section of fig. 1, taken at A. Every aperture which supplies the flame with air must be carefully provided with a diaphragm of wire gauze. When it is intended to light the lamp, a small portion of a mixture of equal parts of chlorate of potassa and sugar is put on the top of the wick; the glass and gauze are then put on a piece of twine, with one end dipped in sulphuric acid, previously put through one of the meshes of the gauze; it is then made to touch the mixture, which causes it to ignite instantly, and this lights the spirit. Need I add, that the wire gauze is to prevent the flame of the lamp from igniting the combustible mixture of gas and air arising from the balloon.* SEPTIMUS PIESSE.

241, Oxford Street.

* A reading lamp might be made upon the same principle, trimmed with oil.

POOLE'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF CAUSTIC SODA AND CARBONATE OF SODA.

(*Abstract of Specification.*)

The nature of the invention of a new method of manufacturing caustic soda and carbonate of soda, consists in the following system or cyclus of operations, by which these products are gained from common salt; that is to say, I first prepare sulphate of soda, by the mutual decomposition of common salt, or chloride of sodium and sulphate of ammonia, by which decomposition, sulphate of soda and hydrochlorate of ammonia are produced. The sulphate of soda is then converted into sulphuret of sodium, by heating it with charcoal or any other carbonaceous substance, and this sulphuret of sodium is decomposed by the protoxide of copper, by which decomposition caustic soda is formed; which, if requisite, may be evaporated to solid caustic soda, or saturated with carbonic acid, and thus converted into carbonate of soda.

The sulphuret of copper afforded by the decomposition of sulphuret of sodium and protoxide of copper, is then calcinated in a current of atmospherical air, by which operation deutoxide of copper is formed; the sulphur being burned and volatilized in the state of sulphurous acid gas. I then combine this latter acid with caustic ammonia, gained by the decomposition of the hydrochlorate of ammonia, by means of lime, exposing hereafter the sulphate of ammonia thus gained to the action of atmospherical air, and regain sulphate of ammonia, which is then again used for decomposing common salt.

Lastly, the deutoxide of copper is converted into the state of protoxide by moderate heating, with a certain quantity of coal. The same cyclus of operations may then be recommended; the ammonia, as well as the protoxide of copper and the greater part of the sulphur, being recovered.

I shall now give a more detailed description of this process or processes, divided in the following seven parts:—

First part.—As the conversion of common salt into the state of sulphate of soda, by its mutual decomposition with sulphate of ammonia, is a well-known process, a description of it will be superfluous. The hydrochlorate of ammonia gained hereby, is used afterwards for restoring sulphate of ammonia, as will hereafter be described.

Second part.—The decomposition of sulphate of soda by means of heating it with coal, charcoal, turf coal, coke, or any other

sort of carbon, is likewise a well-known process; but I recommend to effect this decomposition in any closed vessel, in order to prevent the loss of a large quantity of sulphur, which would otherwise be burned and thus volatilized.

Third part.—The sulphuret of sodium gained by the latter operation, is then dissolved in water and filtrated, in order to separate the remainder of coal (which may be employed for subsequent operation), whereupon protoxide of copper, in the state of a fine powder, is added to the liquid slowly, and in little portions; and by well stirring the matter until the decomposition of the sulphuret of sodium will be just found to be completely effected, by adding to a small portion of it some drops of a solution of sulphate of copper, which, if the decomposition is not yet finished, will produce a precipitate of a blackish colour, but will give a precipitate of a pure blue colour, if the decomposition of the sulphuret of sodium is completely done. The sulphuret of copper is then separated from the liquid containing caustic soda, by filtrating, or in any other convenient manner.

Fourth part.—The solution of caustic soda may then be evaporated to dryness, in case of solid caustic soda being required. If carbonate of soda should be wanted, the solution of caustic soda is to be saturated with carbonic acid. Although any manner for causing caustic soda to get in contact with carbonic acid may be adopted, I prefer to make use of a large vessel or chamber, constructed of bricks and covered on the inside with Roman cement, or any other convenient substance, filled up with pieces of granite, limestone, or any other sort of stone, excepted only such sorts of stones which could be considerably attacked by the caustic liquid. I suffer the liquid to flow gently over the stones, and, at the same time, I introduce a current of carbonic acid gained by the combustion of coal, coke, charcoal, or any other convenient combustible, on the inferior end of the chamber. The carbonic acid passing through the interstices of the stones, will thus be absorbed by the caustic soda, carbonate of soda being formed, which hereafter may be evaporated and calcined in the usual way.

Fifth part.—The sulphuret of copper gained, as described in the third part of this specification, is now to be converted into deutoxide of copper, by calcining it in such a way as to allow the sulphurous acid gas produced by this calcination, to be received in the apparatus destined for the preparation of sulphate of ammonia. I effect this calcination in an iron muffle, heated to a feeble degree of glowing; and I cause a slow current of atmospherical air to pass through the muffle and then into the apparatus, which will be described in the sixth part of this specification. The sulphuret of copper, which may form a couch of about one inch in the muffle, is to be well stirred, until the smell of sulphurous acid is observed to have ceased. The deutoxide of copper is then taken out of the muffle, and a new portion of sulphuret is introduced in such a way, that the muffle may be kept in continual heat. It is now to be remarked, that the deutoxide of copper brought into contact with the protosulphuret of sodium, would decompose this latter so as to form a considerable quantity of hyposulphate of soda mixed with caustic soda. It is in order to prevent this hyposulphate of soda from being produced, that I employ the protoxide of copper, which is obtained by mixing the deutoxide of copper with about one-twenty-eigth of its weight of powdered charcoal or turf coal, and by heating this mixture in a well-closed vessel of iron or any other suitable material, to a feeble degree of glowing.

Sixth part.—I have already observed, that the sulphurous acid gas, by the calcination of sulphuret of copper, is to be received in any apparatus, in order to be saturated with ammonia. I get this ammonia by distilling the hydrochlorate of ammonia gained, as described in the first part of this specification, with caustic lime. In order now to combine this ammonia with the sulphurous acid, I employ a large vessel or chamber, constructed of lead or any other suitable material, filled with chipping of fir-wood. By means of a ventilating apparatus, I cause a moderate current of atmospherical air to pass over the glowing sulphuret of copper in the muffle, as is above described; and after being sufficiently cooled by passing through a pipe surrounded by cold water, to move slowly through the interstices of the chipping. At the same time, the caustic ammonia is also introduced on the upper end of the chamber, and gliding slowly over the chipping, it thereby absorbs the sulphurous acid, and is thus converted into the state of sulphate of ammonia. In order to prevent any loss of ammonia that could be caused by the current of the air leaving the chamber, I employ a second chamber; or if it should be found convenient, several chambers of the same construction as the first, and also filled with chipping, through which the current of air is forced to pass, and over the chipping

of which, a very feeble solution of sulphuric acid in water is caused to flow. By this means the ammonia, which could have been carried off by the air leaving the first chamber, is entirely absorbed, and thus saved; sulphate of ammonia being formed, which may be added to the solution of sulphate of ammonia, the preparation of which forms the last part of the process.

Seventh part.—This process, consisting in the oxydation of the sulphate of ammonia to ulphate, is very easily performed, by exposing a solution of the former salt to the contact of the atmospherical air. I employ for this purpose a frame or scaffold, constructed of timber, in any convenient manner, which I fill with chipping of fir-wood, in such a way as to expose this chipping as much as possible to the access of atmospherical air. The solution of sulphate of ammonia is then caused to flow gently over the chipping, and, being received in a flat chest placed below the chipping, is pumped up again, until it is observed to be entirely converted into sulphate of ammonia, which is hereafter used for decomposing common salt, as is hereafter described. The manner of trying the sulphate of ammonia, or its being perfectly formed, consists in the addition of some drops of sulphuric acid to a small portion of the liquid. If by this addition a smell of sulphurous acid should be observed, the oxydation is not yet entirely finished.

KEENE'S PATENT PROCESS FOR RENDERING LEATHER, &c., WATERPROOF.

(Abstract of Specification.)

The object of this invention is to obtain an outside surface of Indian-rubber to leather, in order to render the same waterproof, and also to offer an external surface to be worn in place of the ordinary dressed or obtained surfaces of leather, which are used for boots, shoes, and other articles, where it is desirable to have a waterproof external surface to leather. The ordinary means heretofore used in producing surfaces on leather, either when tanned or otherwise prepared, has been by dyeing, painting, or gilding it, and afterwards applying a varnish suitable for the purpose, prepared from albumen, resin, or gums which have not rendered them waterproof or impervious to damp; but there has been waterproof leather made, with a polished surface, by coating it with linseed oil and colouring matter, and afterwards working it up to a polish or gloss, by friction or japanning; or japan may have been used upon leather in its ordinary state; but these are liable to chip or crack, when curved or bent in or over an angle. Now the object of my invention is, to produce on leather a surface that shall be waterproof, or partly waterproof, according to the substance thereof, or thickness of the material applied thereto; having all the elasticity, and more pliancy than leather heretofore in use, which shall not be liable to chip or crack, and will be considerably strengthened by the application.

In order that my invention may be fully understood, I will now proceed to describe the method of preparing the materials, and also to explain the process of using the same:—I take 100 pounds of Indian-rubber, and cut it into small pieces, or bruise it into thin sheets between rollers, or by some other means, and saturate it in about 200 pounds of turpentine, or any of the known solvents for caoutchouc, for twenty-four hours, more or less; but that generally answers the purpose, for the caoutchouc has then absorbed the oil or solution, and is fully decomposed therewith. I then pass it through a pair of crushing rollers, set nearly close, which I continue several times; and, while this process is going on, I sift lamp-black or other colouring matter on to it, in sufficient quantity to give it the required hue; and when the whole is worked into one uniform mass to the consistency, or thereabouts, of stout dough or putty—that is to say, neither in a fluid or solid state, I keep it in this condition, in a reservoir of water, ready for use. I would here remark, that the skins or leather to which my invention is best applied, are in the form of what are called doe skin, buck skin, wash-leather, and the like. The skins being prepared in the ordinary manner, I select such as are of uniform thickness, and nearly equal in size; and having adjusted a pair of rollers to suit the thickness of the skins and quantity of pulp required to be laid thereon, the roller which faces the pulp being supplied with a damper of water, keeping it continually wetted thereby, while the process is going on, which prevents the pulp of Indian-rubber from adhering to the rollers, or being drawn from the skins; the other roller should be kept clean and dry, except when desired to put a surface on both sides, which may be put on at once, or one after the other. I prefer having both rollers to lay horizontally, or on an inclined plane, under an angle of 45°, being about eighteen inches in diameter. I commence by placing a skin over the dry

or front roller, in a smooth and even direction, the rollers being turned until they just take an edge of the skin between them; I then wet my hands, and take from the bulk of the pulp of Indian-rubber a sufficient quantity, or rather more than enough, to cover the skin; and I pull or work the Indian-rubber into a long roll, the width of the skin; I lay it close down in the hollow, between the leather and the wet roller. The rollers being then turned, the skin passes through them, receiving a smooth coat of the flexible and waterproof material upon its surface, being thoroughly pressed into the fibres and pores of the leather; and, when dry, it may then be embossed or gilt, in the usual manner of gilding or embossing leather, furnishing it with some material to give it a gloss, and remove the adhesive properties. For this purpose I use shell-lac, dissolved in spirits of wine, with a small quantity of Venice turpentine; or other materials may be used if required. I put two or more coats upon each other upon the surface, and, in some cases, after it is dry, I pass it through either smooth or embossed rollers, or I press it between embossing plates, or smooth ones.

LONDON AND BIRMINGHAM RAILWAY.

From the 17th September, 1838 (the date of the general opening of the line), to the 31st of August, 1840, the passengers conveyed amounted to 1,239,526; the aggregate of miles travelled, to 80,945,952—equal to sixty-five miles and three-tenths for each passenger.

No case of death or fractured limb has occurred to any one passenger. One passenger was severely hurt on the head, on the incline between the Euston and Camden stations; and one, on the back, at the Coventry station. In both instances the parties recovered.

No engine has run off the rails, except in two or three cases, when the points were set wrong at the crossings, which is now effectually guarded against by the present improved plan.

Every engine-driver has the sole care of the engine which he drives, and is required to examine it carefully and clean it thoroughly after each trip.

The number of *passenger* trains running daily, is twenty-eight.

One passenger engine broke an axle on the London side of Harrow, and another a few miles on the same side of Wolverton. A goods' engine, drawing nineteen loaded waggons, also broke an axle one mile from Watford; and all the three (being the only instances of broken axles) brought their respective trains in perfect safety to the Camden station.

The performance of the engines is as follows:—

Number of engines	82
Number of miles run since the opening of the railway......	1,635,396
Average number of miles by each engine....................	19,944
Greatest number by any one engine	41,932

LANCASTER AND PRESTON RAILWAY.

A special general meeting of the shareholders of this railway was recently held at the Town Hall, Lancaster, in pursuance of a requisition, signed by fifty-five shareholders, complaining of the defective accommodation provided for travelling on Sunday, and calling upon the directors to provide additional trains to meet the public wants and convenience. The meeting was not very numerously attended.

The usual arguments resorted to on such occasions were urged by each contending party; on the one hand it was recommended, that all passenger traffic should be suppressed on Sundays, and a feeling of "dread and horror" was expressed, lest any encroachment on the Sabbath should take place. On the other hand, it was contended, that the public had a right to decide, according to their own consciences, whether or not travelling *is* a profanation of the Sabbath. The friends of toleration prevailed; votes being taken for and against the motion, "that public convenience demanded farther accommodation on the Sunday, and that the meeting was of opinion, that one or more additional trains were required; such trains, however, not to run during the hours of Divine service."

The chairman declared the number to be as follows:—

For additional accommodation on Sunday, 117 shareholders having	2446 votes
Against 63 shareholders having	961

The motion for additional accommodation was thereupon declared to be carried.

When we consider the almost boundless toleration extending to every one of the innumerable religious sects in this country, we cannot help feeling much regret, that any of those who enjoy so great

a blessing, should entertain such harsh and unkindly feelings towards others who differ from them in opinion. A country excursion is in itself an innocent, rational, and salubrious recreation; and while those who think it wrong to go out on a Sunday, have full liberty to stay at home or attend a place of worship, without molestation, it amounts to absolute persecution to attempt to coerce others to adopt the same course. The two greatest enemies to religion, are *cant* and *persecution;* and they are the more loathsome and detestable, as they appear in the garb of religion itself.

CALCULATION OF INTEREST.

QUESTION.—What is the number in a table of interest, expressing the value of 1*l.* for 149 days at five per cent. per annum simple interest?

The following is the entire operation:—

```
 3
———  9
 .05 . . .
   9 . .
——————————
.0204109589, interest of 1l. for 149 days.
```

There is no mental calculation in the above operation, every figure is set down as it presents itself by an unerring law, to which the rate is subject. The tabular number of any other number of days, from 1 to 365, being found with equal ease, conciseness, and certainty.

"Querist" requires the investigator to discover the law by which the operation is performed. He also asks—Are all other rates per cent. per annum subject to the same law, or are thère any of them? If all, show how they are so subject? If none, show why not? If any, distinguish which, or how many? And if there be any additional trouble, or any less? Say how these occurrences take place.

"Querist" puts this question likewise:—What is the least number of operations requisite to construct a table of interest for every number of days in the year (that is, 364 numbers), and how many lines sufficient to express it?

The great utility of the rule which originates with this law is obvious. For example:—

Find the interest of 10,402*l.* 14*s.* 2*d.* for 149 days at five per cent. per annum?

```
 3
———  9
 .05 . . .
  . 9 . .
——————————
.0204109589, interest of 1l. for 149 days.
 807.20401   the multiplier (that is, the principal) inverted, and three decimal
——————————       places retained, and then by the well-known con-
  204110         tracted method of multiplication—
    8164
      41
      14
——————————
 212,329 or 212l. 6s. 7d. the interest.
```

Should it be desirable to have the result in shillings, a corollary arises in course of investigation which develops the rule.*

MECHANICAL PROBLEM.

To the Editor of the Mechanic and Chemist.

SIR,—I trust that you, or some of your worthy correspondents, will answer the following question:—

Supposing that I have two shafts to sink, or, at least, that they are already sunk, the one to be 100 yards deep, the other 160, the same engine to wind out of both alternate, that is, one up and the other down; the diameter of the barrel that winds out of the 100 yard pit, is two feet six inches when all the coil is off; when the coil is on, it is eight feet in diameter; and the barrel of the 160 yard pit is to be placed on the same axis; what size barrel would be required (when the coil is off) to work them both up and down alternate? A full illustration of the above in the "Mechanic and Chemist," will greatly oblige a constant reader,

PHILOLOGUS.

[If the ropes were to wind round cylin-

* Gentlemen desirous of communicating with "Querist" on this subject, will please address, "P. Gaynor, at the School of Theoretical and Practical Science, 31, Sheffield Street, Dublin." All letters post paid.

ders of uniform diameter, their proportion would be as the depth of the lesser shaft to that of the greater; but as each revolution of the axis adds one coil of rope to each of the cylinders, their diameters must increase in arithmetical progression, and destroy the original proportion. Take therefore, the mean term of the given diameters (5.25 ft.), and say 100 : 160 : : 5.25 : mean term of greater cylinder, which gives 8.4 ft., and deduct 2.75 (half the coils of rope), 5.65 ft. will be the diameter required. Universally, if a be the diameter of lesser cylinder when the rope is off; b, ditto, when all the rope is on; C, depth of lesser shaft; D, depth of greater shaft; x, diameter of greater cylinder without the rope; and y, ditto, with all the rope on,

then $\overline{a+\frac{b-a}{2}} \times D = \overline{x+\frac{y-x}{2}} \times C$.

In this calculation it is assumed, that the diameters increase and decrease uniformly, as if a band of equal thickness throughout were wound upon itself, so as to form a compact spiral; but it will be found in practice, that considerable variations will occur, unless the ropes be so arranged as always to coil in the same order on the cylinders.—Ed.]

MISCELLANEA.

A single train from Leeds to Sheffield, lately performed the journey with no less than 2400 passengers! The train consisted of seventy-three carriages, and was drawn by four engines.

Newton found, that a ball of glass, or a watch-glass laid upon a flat surface of glass, does not touch it, and cannot be made to do so by the force of even 1000 lbs. to the inch.

To Bleach Vegetable Wax.—Mr. E. Solly, in experimenting for the purpose of bleaching vegetable wax, found that the best effect was produced by chlorine, but that it is necessary that the materials used to evolve the gas, should be intimately mixed with wax; but when a stream of chlorine was slowly passed through the wax, the process became very tedious. He subsequently found that strong nitric acid was a powerful decolorating agent, and possessed the advantage of having no residue which is at all difficult of separature; but this process is expensive. Mr. E. Solly subsequently employed the following process:—The wax was melted; a small quantity of sulphuric acid was poured in, composed of one part of oil of vitriol to two of water, and then a few cyrstals of nitrate of soda stirred in; the whole was then agitated with a wooden stirrer and kept heated. Nitric acid was thus evolved in considerable quantity and purity from a large surface, and in such a manner that all the acid evolved must necessarily pass through the melted wax. This method answered the purpose very completely, the process was cheap and rapid, and the residuum, being merely a little solution of sulphate of soda, was easily removed. When it is desired to employ chlorine in the place of nitric acid as the bleaching agent, the same process may be adopted.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 4, R. H. Semple, Esq., on the Metals. Friday, November 6, W. H. Woolrych, Esq., on the Duties of an English Magistrate. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Nov. 5, S. Preston, Esq., on Pneumatics. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Tuesday, November 3, Rev. J. C. Means, on the History of France. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 4, H. Jones, on Botany. At half-past eight precisely.

QUERIES.

A pole, sixty-three feet long was broken by a blast of wind at a certain distance, C, from the ground; so that the top of the pole struck the ground at A, twenty-one feet distant from the base of the pole; the question is, how long is the standing piece? A. M. A.

Are there any patents in force for the manufacture of vinegar; and if so, to whom granted, and when? The best method of manufacturing wine or beer from the sugar beet? Also, the cheapest system of heating by warm water a room on the ground floor, 20 feet by 10 feet, 12 feet high, so as to obtain 140 degrees of heat? Rowlund.

The mode of preparing a blue ink which does not decompose, and also a copper ink formula? A. N. S.

A description of the simplest practical means of taking a cast of the head and face of a person (more particularly the forehead and face) for phrenological purposes? G. S. Jun.

The manner in which an electro-magnetic engine is constructed, where permanent magnets are used instead of the battery? G. M. W. H.

How medallion wafers are to be made, and how the impression may be removed off the seal, or whether it is requisite to prepare the seal with

some unctuous matter previous to using the composition? E. D.

The best method of making sky-rockets; also, how the stars are made that are placed on the top? E. C. B. H.

ANSWERS TO QUERIES.

Chemical Weather Glass.—I beg leave to inform "A. C. P." that the description of the *Chemical Weather Glass*, which I sent for insertion in the "Mechanic and Chemist," is abridged from Smith's "Panorama of Science."— Smith refers to Wight as his authority.

E. Ledger.

To preserve Animal and Vegetable Substances.—A correspondent asks "What is the best method of preserving Animal and Vegetable Substances." Various methods have been employed by differeut people, but the following extract from the report of Professor Henslow and Committee "on the Preservation of Animal and Vegetable Substances" read before the *British Association*, will, I think, afford him most information:—"The attention of the Committee was directed to the preserving properties of certain materials when applied separately, either in saturated solutions, or in different degrees of concentration. The experiments were conducted in jars six inches by one and a half; and saturated solutions of the substances employed having been prepared, were diluted with an equal and double quantity of water; 178 preparations of animal and vegetable substances were tried.

1. *Results obtained with Animal Substances.*—Three salts of potassa—the subcarbonate, the bicarbonate, and the arseniate, have afforded the most satisfactory results. The solution of the bicarbonate afforded a flocculent precipitate: the solution half saturated appeared the best adapted. The substances preserving next best are, sulphate of zinc, muriate of magnesia, sulphate of potassa, and alumina (common allum), muriate of ammonia, sulphate of potash. Corrosive sublimate is a perfect preservative of animal substances; but this salt renders the substances so very hard, that singly it is unsuited to the purposes of natural history; added in small proportions to other solutions, which render objects too soft, it will probably be found of essential service, as well also in preventing the formation of flocculent matter. One part of naphtha to seven of water produces a favourable result, but when used stronger, the specimens are rendered tough. Acetic and oxalic acids decomposed the skin and cellular membrane of fish, but left the muscles untouched. A few drops of kreosote added to water, preserve the objects, but they become stained dark brown. The following substances are entirely unfit for preservatives: carbonate of ammonia, chloride of potash, muriate of barytes, muriate of lime, nitrate of ammonia, nitrate of strontian, the nitrates of barytes, soda, ammonia, and magnesia, phosphate of soda, the sulphates of potash, iron, copper, and rough pyroligneous acid.

2. *Results obtained with Vegetable Substances.*—The success here is very slight. None of the salts seem favourable, with the exception, perhaps, of the sub-carbonate and bicarbonate of potash. In naphtha and acetic acid, the specimens are preserved, but in the latter they lose their colour, and assume a reddish tinge. Professor Henslow adds, that, although carbonate of soda of the shops is not mentioned in the report, he finds it to possess considerable preserving powers on animal substances. Fruits and other parts of vegetables may be preserved well in a solution of common salt and water. Arseniate of potassa also preserves the colour of flowers well." P. Truman.

TO CORRESPONDENTS.

W. Harlington.—*The figures placed on the right-hand-side of the point, are decimal fractions; all decimals may be converted into vulgar fractions by drawing a line, and placing under them as many 0's as there are figures in the decimal, and a 1 at the left of them:* 71.80, *means* 71 *and* $\frac{80}{100}$. *So, when there is but one decimal figure, it expresses the number of tenths; when there are two decimal figures, they express the number of hundredths, and so on to any number of figures. The decimal mode of calculation is more convenient, but, in many cases, less accurate than vulgar fractions.*

Specific gravity is the weight of a given bulk of any substance; the specific gravity of silver is to that of tin, as the weight of a cubic inch of silver is to the weight of a cubic inch of tin.

The height of mountains &c. is found by the barometer; the height is not usually estimated from the surrounding country, but from the level of the sea; that is, reckoned from a point which would correspond with the surface of ths sea, were it allowed freely to flow there.

No compression will cause atmospheric air to explode, because it does not possess the necessary elements of combustion; but it will produce an evolution of heat, sufficient to ignite inflammable matter such as amadon or german tinder &c. this phenomenon is explained by the doctrine of latent heat.

This day is published, price, with Tuck and gilt edges, 2*s.*; or in neat fancy binding, 1*s.*,

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A MAGAZINE OF THE ARTS AND SCIENCES.

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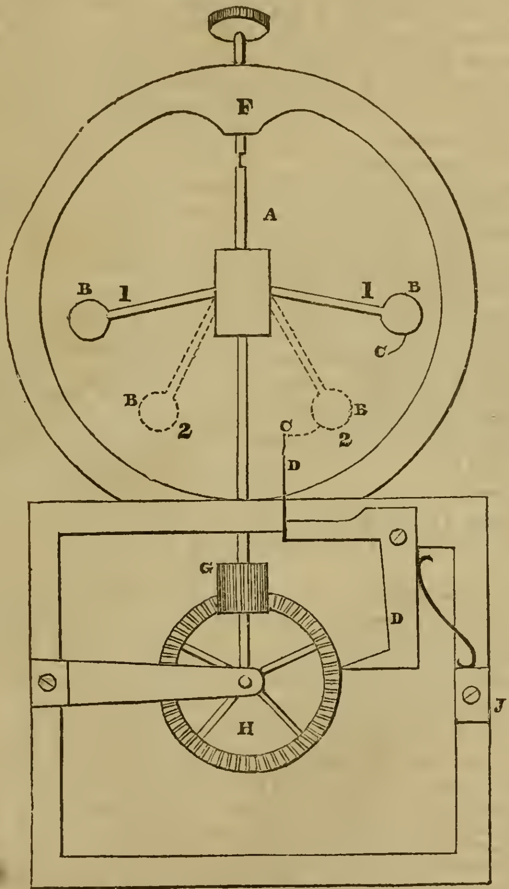
PATERSON'S CENTRIFUGAL ESCAPEMENT FOR CLOCKS.



 City Press, 1, Long Lane: Doudney and Scrymgour

CENTRIFUGAL ESCAPEMENT FOR CLOCKS.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—F F is a circular band or ring, having a cock attached at top for the pivot of the upright pinion, A, to act in an upright pinion, G, having sixteen leaves, which acts in contact with the contrite wheel, H, which has six teeth cut out, to allow the pinion, G, to revolve; B B, two balls attached to a lever, working in the frame of A, by means of two pivots. No. 1 shows the full extent of velocity of the two balls. No. 2, the balls as when their power is expended; C, a pin attached to one of the balls, which, when the velocity of the balls, No. 2, is expended, strikes the detent D, which causes the contrite wheel, H, to perform one revolution; T, a spring acting on the detent, D, to return it to its place.

I am, Sir, yours, &c.

J. PATERSON.

[We have omitted a portion of our correspondent's description, it being too obscure to be understood. The principle, which we believe to be entirely new, will, however, be easily seen by inspection of the engraving. This construction is objectionable, in being subject to considerable variation, when any alteration takes place in the power applied to the pinion, G; but as an ornamental escapement, where extreme accuracy is not required, it might be made a very beautiful object; and we recommend it to the attention of our horological friends.—ED.]

LOWE'S PATENT IMPROVED METHOD OF MANUFACTURING GAS.

(Abstract of Specification.)

THIS invention relates to a mode of combining and working retorts in the manufacture of gas from coal, and in such manner, that the products alternately of one of two retorts shall be caused to pass into, and mix with, the products of the other retort; by which means, whichever of the two retorts has been last charged, the products thereof during the early hours of working, shall pass into the retort, which, with its charge, is in a highly heated state, from its having been much longer at work; and the retorts are so connected, that, by means of a valve and apparatus external of the brick-work of the setting of the retorts, that, during the time of discharging and charging either of the retorts, the gas from the other retort shall not pass into the retort with which it is connected, and which is long discharged of its contents, or recharged with coal.

Two retorts are connected together at the back ends, by means of a pipe, having an ordinary slide valve, by which the communication between the two retorts can be shut during the time of charging or discharging either of those retorts; and they are not charged at the same time, but at an interval of three or four hours apart—that is, about half the time of working off a charge.

Another part of this invention relates to the combined using of clay retorts and iron retorts. In setting iron retorts, as is sometimes practised when working according to what is called the descending flue-pan, the upper retorts of iron are usually shielded or protected with fire-bricks or tiles, when the furnace is so arranged as to cause the products of combustion to pass downwards, after having ascended and passed over the upper retort or retorts, as is very commonly practised; and such shielding or protecting the upper iron retorts is rendered necessary, owing to the great heat to which the upper retorts, under such circumstances, are subjected. In some cases, clay retorts have been used, but without combining therewith retorts of iron in the same furnace or oven; by which arrangement, although beneficial in respect to the upper retort or retorts, owing to the great heat to which they are liable, such arrangement is not beneficial for the lower retorts, which, being operated upon by a much lower degree of heat, the slow conducting properties of clay retorts do not, in such situations, offer that quick means of transmitting the heat to the interior of such retorts as is desirable.

Now the object of the second part of the invention is, to employ upper retorts made of clay, and the lower retorts made of iron.

By this arrangement it will be seen, that at those parts of the oven where the greatest heat will be found to exist, the retorts are made of clay; and at those parts where the temperature will be much less, and where it will be desirable to conduct the caloric as quickly as possible into the retorts, the better conductor, iron, is employed for such retorts.

Another part of this invention relates to a mode of applying heat to retorts during the early hours of decomposition. It is well known that, during the early periods of the working off of a charge, much of the products evolved are not converted into permanent gas, but are condensible

vapours, which arise from the circumstance of cooling down of the retorts by the fresh charges of coal: hence it is desirable to have a more excited combustion of the fuel employed during the early hours of distillation, than has heretofore been practised; and this part of the invention consists in applying a blast of air into the ash-pit of the furnace, the ash-pit being closed; as is well understood in constructing furnaces with closed ash-pits, for other purposes. And when the retorts have been fresh charged, a blast of air is to be forced into the closed ash-pit, in order to excite the fire in the furnace, that it may continually keep up the heat of the retorts, notwithstanding the quick rate at which the heat is taken up and carried off by the charges of the retorts, during the early part of the distillation; and such blast of air is continued for about two or three hours, and then open the ash-pit and permit the fire to burn by its ordinary draught.

Another part of the invention relates to a mode of heating retorts in the manufacture of gas; and it consists of an improved mode of employing gas-tar as a fuel. Breeze or small cinder is mixed with a quantity of coal-tar, to saturate it, which is charged into one of the retorts, and the distilled products conducted by a pipe from such retort to the fire of the furnace, which is heating that and other retorts in the same oven; by this means we are enabled beneficially to consume coal-tar. This part of the invention will be found particularly advantageous, when the number of retorts in an oven or ovens are too many for producing the quantity of gas required at a given time, which is often the case, and in place of letting the retorts lie idle; in such cases, the products from them, when charged with breeze and tar, would be turned into the fire, by having pipes applied to the mouth-pieces or other convenient parts of the retorts; and, when it is desired again to use such retorts for manufacturing gas for the purposes of illumination, the cocks or valves, which are placed on the additional pipes leading to the fire, are to be closed.

Another part of the invention relates to a mode of constructing and working retorts, which are set vertically, or nearly so, and so arranged as to be charged at the upper ends, and, from time to time, drawn at the lower ends; and wherein the fresh charges are constantly descending towards the lower ends; and the novelty of the invention consists in so constructing such retorts, as to cause the gas evolved from the fresh charges to descend, and pass amongst the highly-heated charges, and mix with the gas evolved therefrom; whereby a similar result will be obtained to that first described—the products of gas evolved from the fresh charges not being permitted to pass off by themselves, but are caused to mix with the products of gas evolved from charges which have been much longer under operation.

STONE'S PATENT RHUBARB WINE.

(Abstract of Specification.)

When the green stalks or stems of the rhubarb plant are arrived at their full size, which will generally be about the middle of the month of May, I pluck from the plant the stems or stalks; I then cut off the leaves and throw them away; I bruise the stalks or stems in a large mortar, or other convenient means, so as to reduce them to a pulp; I put the pulp into an open vat or tub, and to every five pounds' weight of the stalk or stem, I add one gallon of cold spring water. I let it infuse for three days; stirring it three or four times in a day: on the fourth day I press the pulp in the usual manner, and strain off the liquor, which I place in an open vat or tub, and to every gallon of the liquor I add three pounds of white loaf-sugar, stirring it until the sugar is quite dissolved; I then let it rest, and in four, five, or six days, the fermentation will begin to subside, and a crust or head will be formed, which is to be skimmed off, or the liquor drawn from it, just when the crust or head begins to crack or separate; I then put the wine into my cask, but do not then stop it down. If it should begin to ferment in the cask, I rack it into another cask; in about a fortnight I stop down the cask, and let it remain till the beginning of the month of March in the next year, when I rack it, and again stop down the cask; but if, from continued slight fermentation in any cask, the wine then should have lost any of its original sweetness, then I put into the racked wine a sufficient quantity of loaf-sugar to sweeten it, and stop down the cask, taking care in all cases that the cask should be full. In a month or six weeks it will be fit to bottle, and in the summer to drink; but the wine will be improved by remaining a year or more in the rack after it has been racked. I would remark, that the plant in the autumn (about the latter end of August) will produce a second crop, when I make another quantity of wine, by pursuing a like process.

KOBER'S PATENT IMPROVEMENTS IN FIXING COLOUR IN CLOTH.

(*Abstract of Specification.*)

In consequence of the great affinity of bichromate of potash to the wool, as well as to the colouring ingredients, a comparatively small quantity of bichromate of potash will fix the dye-wares; that is to say, one pound weight of bichromate of potash can be used, instead of from three to four pounds' weight of alum or copperas; besides which, the colour produced by the use of potash, is fast in alkali and air, and better resists the operation of scouring, and the milling process employed in the manufacturing of cloth; and less colouring ingredients are required to be used than by the ordinary mode, because the colour produced thereby being faster, no loss of colour will take place by scouring the cloth with soap; and the fibres of the wool, in the dyeing of which bichromate of potash is employed, will not be injured (as they hitherto have been) by the acids contained in alum or copperas, and, on the contrary, the cloth will be softer and easier to be scribbled and milled, and, consequently, the same quantity of wool will produce a greater and better quantity and quality of cloth than by the method usually employed. I find the use of bichromate of potash most successful in preparing the wool for the reception of the colouring ingredients, particularly by fixing logwood, fustic, and wold, while redwoods and madder are less advantageously acted upon. As the ordinary colouring ingredients are employed in my application of the bichromate of potash; and as every different shade and colour require a different proportion of ingredients, and as the dye-wares differ so much in quality, that sometimes a double quantity of them is required: it is impossible to state the different proportions in which the bichromate of potash should be used with them; the weight of bichromate of potash to be employed, varying according to the quantity of ingredients to be fastened to the wool; but I generally employ three pounds' weight of bichromate of potash for preparing 100 pounds' weight of scoured wool, and I sometimes add two pounds' weight of argol or tartar, and in the liquid thus produced, I boil the wool for one hour and a half; and on the next day I fill the colour up with as much of the colouring ingredients, as the desired shade may require.

My invention consists, secondly, in obtaining green colours perfectly fast in acids, alkali, and air, by dyeing the wool blue, and then manufacturing the cloth from the blue wool, so as to make it what is called partly finished cloth with a white or light coloured list and head-ends, and then adding the yellow wares or ingredients to the cloth instead of to the wool; by which means a perfectly fast green colour will be obtained, in appearance like to wool dyed green, but much faster.

The modes of dyeing yellow are too well known to require any explanation; every kind of yellow ware is applicable to my invention, but I prefer fustic for its fastness; and in thus dyeing the partly finished cloth yellow, and in order to fasten the colour, I use hydrochloric acid saturated with tin, to which I add as much water as will give the solution a specific gravity of 12.612 or 30 degrees Baume; and of this solution I use from six to seven pounds' weight, for every one hundred pounds' weight of cloth, besides the usual quantity of alum and argol. This solution could not be applied to wool in flexes, as it would be destructive to the use of soap, and consequently to the milling process.

My invention, thirdly, consists, in the use of soda and bran for dissolving the indigo in the vats for dyeing wool, whereby the indigo is better fixed to the wool, and at a less expense than is incurred by the use of wood, madder, and bran, which are usually employed for that purpose. I use soda in the proportions, and in the manner next hereinbefore described; that is to say, in a seven-feet vat I heat the water to 125 degrees Fahrenheit; I then throw into the vat 65 pounds' weight of bran, 35 pounds' weight of common soda, which has about 23 per cent. of carbonate of soda, and four pounds' weight of indigo; I then proceed in the same manner as is usual in wood vats, by adding the usual and requisite quantity of lime; I then work the vat, from 110 degrees to 118 degrees Fahrenheit, three or four times during the day, without stirring; in the evening I again heat the vat to a temperature of 125 degrees Fahrenheit, adding an additional quantity of about four pounds' weight of lime, six pounds' weight of bran, and five pounds' weight of soda, with such an additional quantity of indigo as I may require to answer. On the following day, and in the evening after this addition is made, I stir the vat as usual, at the above-named temperature of 125 degrees. If the vat has been working during the day, I add the above quantity of lime, bran, and soda every evening, which is necessary to keep the vat in a proper state, even if no indigo is added. The vat being kept in such

working state, I from time to time add as much additional indigo in the evening as I may require to consume the following day. It is impossible to state the exact quantity of indigo to be added. Any quantity of indigo, from half-a-pound weight to 25 pounds' weight may be added, according to the shade of colour required to be produced, the following day. After proceeding in this way for about eight or ten weeks, I do not empty the liquor in the vat; but I withdraw, or take out the sediment, and, with the liquor in the old vat, I set a new vat, adding thirteen pounds' weight of bran, and ten pounds' weight of soda, with as much lime and indigo as I may require. As the use of lime is to check the fermentation produced by the bran, it is impossible to state the exact quantity of lime which may be required. I employ as much lime as will check the fermentation in the vat to such a degree, as will be sufficient to deprive the indigo of its oxygen without an immoderate fermentation, which is very prejudicial. The same observation and application is necessary in working what I call my soda-vat, as it is in the ordinary wood vats, except that I do not employ any wood or madder; but soda may be used in conjunction with wood, madder, or bran; but I prefer using the soda with the bran only. The vat in which I use the soda must be perfectly yellow; that is to say, the indigo must be perfectly deprived of the oxygen; as it is generally termed, the indigo must be "sprung," in which case the vat appears yellow. By the use of soda-ashes (which have forty-six per cent. of carbonate of soda) instead of common soda, half the quantity will produce the same effect. Pearlash may likewise be employed, if the price will admit of it, and fine sharps may be used instead of bran. I therefore claim, as my invention, first, the use of the bichromate of potash as a substitute for copperas, alum, and other mordants.

Secondly, the production of perfectly fast-green colours, by dyeing the wool in blue, and adding the yellow ingredients, after it has been manufactured into cloth.

Thirdly, the use and application to indigo of soda and bran, or soda-ashes and bran, either by themselves, or mixed with wood and madder; whereby the colour is fixed to the wool better and cheaper than by the use of wood and madder alone.

PROGRESS OF EDUCATION.

To the Editor of the Mechanic and Chemist.

Sir,—I am happy to state, that the desire for education and moral improvement, which has long been glimmering in the neighbourhood of Coalbrook Dale, has at last been fanned into a flame. A gentleman of the name of Broffnore, who is travelling through England, lectured at Ironbridge on the benefits of moral and intellectual improvement, and the advantages of mechanics' institutes. This lecture had a good effect in arousing our dormant energies; and several gentlemen came nobly forward and offered their assistance in starting and supporting a mechanics' institution at Ironbridge. On the following Wednesday, the 21st of October, a public meeting was held in the infant school-room, Ironbridge, to take this subject into consideration; the business was settled by forming a committee of thirty persons—one-half gentlemen and tradesmen, the other half working men—to adopt the best means for forming an institution; and eighty-eight names were enrolled as members. Never do I remember hearing of a mechanics' institute beginning under more auspicious circumstances; situated, as it is, in the centre of a populous neighbourhood, with the united talents of the celebrated (Coalport) porcelain manufactory on one hand, and the extensive iron works of the Coalbrook Dale and Madeley Wood Companies on the other. The workmen already appear to appreciate its value; for, during the course of three or four days, the names have increased to 160. I trust we shall shortly be firmly established, and that the same favourable omens which have marked our commencement, will continue with us through our career; may hundreds reap the benefit that will be conferred upon us by this institution, and may its beneficial influences be extended to a rising generation, who will then greet with pleasure each succeeding anniversary, and gratefully look at the names in their records, of those gentlemen who first stepped nobly forward, and planted an institution at Ironbridge.

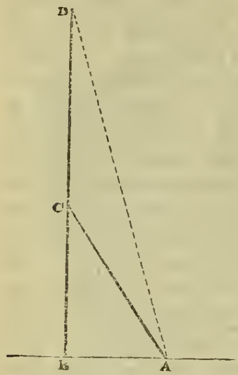
I remain thine respectfully,
John Child.

Coalbrook Dale, Salop,
Oct. 28th, 1840.

[We are much gratified to learn that the laudable exertions of our worthy correspondent and his friends, have led to so successful a result; and we trust that so

good an example will be followed in many other places, and ultimately produce the greatest benefit to the working classes. We shall always be happy to promote, to the utmost of our power, the success of such excellent institutions.—ED.]

GEOMETRICAL PROBLEM.



A POLE, sixty-three feet long, was broken by a blast of wind at a certain distance, C, from the ground, so that the top of the pole struck the ground at A, twenty-three feet from the base, B; how long is the standing piece, B C?

ANSWER.

	Logarithm.
As A B, 21 + B D, 63 = 84	1.92428
: B D, 63 — A B, 21 = 42	1.62325
:: Cotangent $\frac{1}{2}$ ∠ B = 45°	10.00000
: Tangent $\frac{1}{2}$ (∠ B D A ∽ ∠ B A D)	9.69897

Tangent 9.69897 = ∠ 26° 34′; consequently,

∠ B D A = 18° 26′

∠ B A D = 71° 26′

But ∠ C A D = ∠ C D A; therefore,

∠ C A B = 53° 8′, and ∠ A C B = 36° 52′.

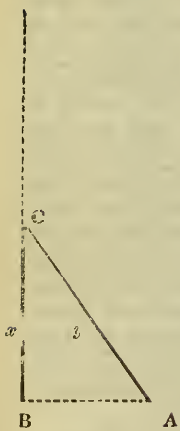
	Logarithm.
As sine ∠ A C B, 36° 52′	9.77812
: A B, 21	1.32222
:: sine ∠ C A B 53°0′	9.90311
: B C, 28 feet	1.44721

Therefore B C = 28 feet, and C A = 35 feet.

PROOF.

Square of C A, 35	1225
Minus square of B C, 28	784
Leaves	441

Square of 21 is 441.



BY ALGEBRA.

Let the part C B = x, the length sought, and C A = y;

$$\text{Then } 63 - y = x;$$

$$y^2 - 441 = x^2;$$

$$3969 - 126y + y^2 = x^2$$

$$3969 - 126y = y^2 - 441;$$

$$4410 = 126y;$$

$$35 = y; \text{ consequently, } x = 28.$$

G. S. Jur.

MISCELLANEA.

Electrical Clock.—A German artist, now in London, is about to take out a patent for the invention of a clock, worked by electricity. The machine, which is remarkable chiefly for its extreme simplicity, is composed only of a pendulum, one large wheel, two escapements, and a quadrature. Such are the visible parts. We must suppose, however, that a pinion and a wheel form the communication between this great wheel and the quadrature, though these are not to be seen. The pendulum, at each vibration, causes one of the escapements to advance the

great wheel one tooth; which, after this movement, has a pause, making the dead second. As there is no metallic moving power to set the machine agoing, we find, on examining, what keeps up the motion; that the pendulum (which is almost out of proportion with the clock) descends into a case, and there, at each vibration, the ball or body, which is furnished with a conductor, approaches alternately two poles, to which voltaic piles supply their portion of electricity. So that the pendulum, when once put in motion, retains it by means of the electricity alternately drawn from the two poles. There can be no doubt that other interesting results may be obtained, by employing the electrical fluid as a motive power, however slight the power which such an agent may seem capable of communicating.

Locomotive.—Mr. E. Rudge, of Tewkesbury, tanner, has obtained a patent for a new method or methods of obtaining motive power for locomotive and other purposes, and of applying the same. These improvements are for the construction and application of a new form of atmospheric engine, which may consist of two, three, or more open-topped cylinders, placed either vertically or horizontally, the piston rods of which are connected with two or three throw-cranks. The air below each piston in the cylinder is condensed by a jet of steam, when the preponderating influence of the atmosphere on the external surface of the several pistons produces the available power. The cylinders are lubricated by means of a small funnel on the top of the piston rod, whence the oil flows into a hollow space within the rod, and thence into a groove turned in the piston. In order to gain a reserve of power for any particular purpose, a large cylindrical receiver is filled by a condensing air-pump placed on either side, and connected with the main shaft of the engine; thus, when the carriage is descending a hill, the air-pumps will compress the air into the large cylinders, which again will supply the air for working the pistons while ascending a hill.—*Gloucestershire Chronicle.*

Railways in the United States.—In Pennsylvania, the number of railroads is thirty-six, the number of miles opened 576½, the total length of road 850¼, and the amount already expended, 15,640,450 dols. In Virginia, the Carolinas, Georgia, and Florida, there are twenty-three roads, and 994 miles opened; total length, 1675½ miles; amount expended, 18,442,000 dols. In Albama, Louisiana, Mississippi, Tennessee, and Kentucky, there are twenty-seven roads, 195 miles in operation; total length of roads, 1148¼ miles; already expended, 9,621,000 dols. In Ohio, Indiana, Michigan, and Illinois, there are twenty-nine roads, 196 miles in operation; total length of roads, 2821 miles; amount expended, 5,523,640 dols.

The archway of Ann's Hill, Brockhurst, intended for the Gosport branch of the South Western (or Southampton) Railway, fell in yesterday week with a great crash. The reason assigned for this is, that the brickwork is put together with cement, instead of lime, which dries on the instant, and does not give to the pressure; the consequence is, that if it does not at first adhere, the work will fall on any heavy weight going over it. —*Hampshire Herald.*

To Prevent Accidents on Railways.—The late lamentable accident on the South Western Railway, has, as is usual in such cases, given rise to various suggestions, with a view to prevent the recurrence of similar calamities. One of these is thus described by a correspondent of the *Times:* —" Until some effectual mechanical contrivance is invented to prevent or to diminish the effect of the collisions of trains, two persons should be appointed as 'look-outs' to each train; one to sit near to the engineer with his face directed forwards, the other to have a seat affixed to the last carriage, and his attention constantly occupied on the line over which they have passed; in fact, to turn his back upon the journey he is pursuing. Let the first man be provided with 'blue-lights,' something like what are called 'Roman candles,' of sufficient magnitude and brilliancy to be seen at a considerable distance, and let him be instructed to discharge these at short intervals; the 'look-out' behind would then see when a train was approaching (practice would soon teach him to calculate the speed), and give the alarm to his conductor, and the 'forward look-out' of the approaching train would also exercise similar vigilance, and be able to give the engineer instructions to slacken his speed at a sufficient distance, if not to prevent, yet most materially to diminish, the effect of a collision. The expense and danger (?) of this may be objected to, but in this age of invention, I have no doubt of a cheap, harmless, and efficient alarm being produced. The approaching long nights especially demand that immediate measures be taken for the protection of passengers by railway. I would not, however, be understood as confining this precaution to darkness; for daylight requires it also, and, if necessary, the colour of the projectile might be changed."

A schoolboy, carrying about him a pocketful of marbles, carries enclosed in these playthings, air sufficient in quantity, and sufficiently noxious in quality, to prevent him, if he received it into his lungs, from ever playing at marbles any more. Again, from a very small quantity of red-lead, so much air of another kind may be extracted, as, if the boy were to breathe it, when almost dead from the effects of his marble dose, would rekindle the expiring embers of life, and give him the power and disposition to roll his mortal and innocent bullet about again.

The fen districts in the Bedford level alone, amount to nearly 300,000 acres. This tract of fenny land extends over a portion of Norfolk, Suffolk, Cambridge, Huntingdon, Northampton, and Lincoln. It derives its name from the Earl of Bedford, who succeeded in draining it in 1649, after many previous unsuccessful attempts. The whole of the fen and marsh lands in England is, perhaps, not less than 800,000 acres.

It appears from the bills of mortality, that, in the latter part of the last century, the deaths from small-pox in the metropolis, averaged 2000 annually, or about one-tenth of the total mortality. In the year 1796, it prevailed with such severity, that, in the metropolis alone, 3549 lives are re-

corded to have been sacrificed to its virulence. The deaths by small-pox throughout England before the year 1800, were computed to be 45,000 annually.—*Lond. Sat. Journal.*

Horses will not touch cruciferous plants, but will feed on red grasses, amidst abundance of which, goats have been known to starve; and these latter, again, will eat and grow fat on the water-hemlock, which is a rank poison to other cattle. In like manner pigs will feed on henbane, while they are destroyed by common pepper; and the horse, which avoids the bland turnip, will grow fat on rhubarb.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 11, R. D. Grainger, Esq., on the Nutritive Processes in Animals. Friday, November 13, R. D. Grainger, Esq., in continuation. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Nov. 12, Capt. Saumarez, R.N., on the Origin and Progress of the Art of Restoring Suspended Animation. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 9, T. C. Bowkett, Esq., on the Philosophy of Health. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 11, Mr. R. S. Jeffs, on Hydrogen. At half-past eight precisely.

QUERIES.

How to remove spots from polished steel, without injuring the polish? T. E. B.

How to render plaster casts impervious to the weather, without altering their colour? How to put a polish on them when not exposed in the air; or any information as to their preservation? I think I remember hearing of a receipt which was either a preparation of wax or soap.

A. H. Hedingham.

What is the best liquid for cleaning brass window-frames? W. B.

How to make the bleach used in manufacturing white calf boot-tops, or what will answer as well? W. Cloud.

The method of bleaching animal fat? It would be of great service to the trading community, if you would give such information in one of your earliest publications. That such process is in use, I am well aware, at the large manufactory of Messrs. Hawes, Commercial Road, Lambeth.

C. C. J.

What is the size of the largest crab-engines made, and its proportions, with a drawing, if convenient? J. Marriott & Co.

I am a brewer on a small scale, and have not room to fix a cooler; can any of your readers inform me, through the medium of your columns, of anything to keep water cold, so that a pipe passing through a butt may answer the purpose of a cooler? A. B.

Blackburn.

ANSWERS TO QUERIES.

In answer to your correspondent " N. M.", I beg to say, that the quickest and easiest method of killing oak, ash, &c., so that the trees shall remain standing, is by causing them to undergo the process called ringing, which is thus performed:—Take a bill-hook or small hatchet, and chop away a portion of the bark all around the stem of the tree, until the wood is laid bare; this breaks the communication of the sap from the root to the different parts of the tree, and in a short time destroys it. This operation is much practised in America, for clearing away the large forests which there abound.

D. Davison.

TO CORRESPONDENTS.

An Amateur Mechanic's *suggestion deserves serious consideration; it will not be lost sight of.*

Green paint, &c., is only an imitation of bronzing. The proper bronzing liquid is chiefly composed of linseed oil and turpentine, combined with the required colouring matter, and hardened by exposure to considerable heat, as in the process of japanning.

S. Whitelaw.—*Electrotype impressions may be produced in various kinds of metal; but not in the substances he mentions.*

Hope.—*The 5 at the eleventh place of decimals is a typographical error, and must be expunged. His other query shall be attended to.*

J. B.—*We are not in possession of the information he requires, but will endeavour to obtain it.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 119, NEW SERIES. | SATURDAY, NOV. 14, 1840. PRICE ONE PENNY. | No. 240, OLD SERIES.

HADDEN'S PATENT PROPELLER.

Fig. 1.

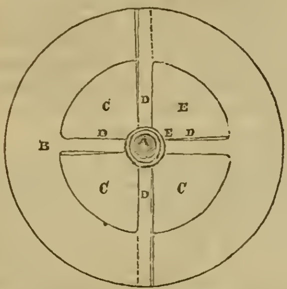
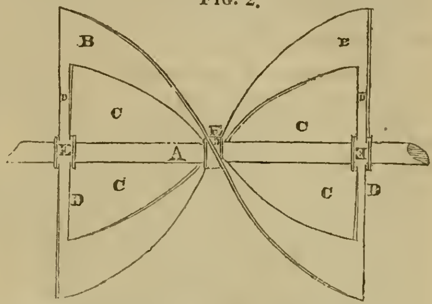
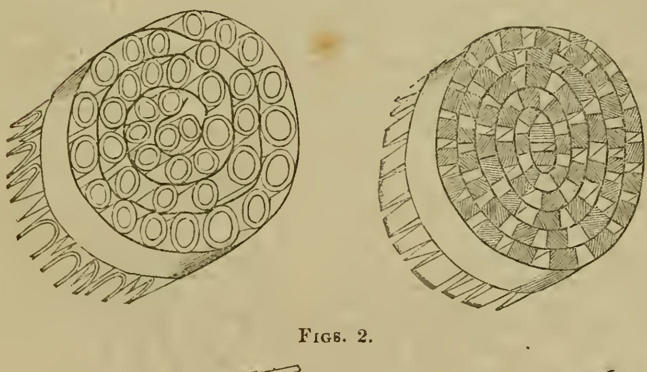


Fig. 2.

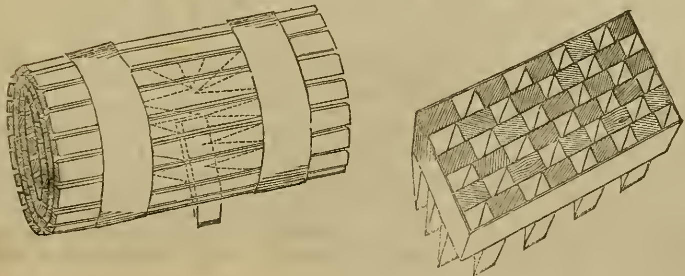


EDWARDS'S PATENT FOR PREPARING AND COMBINING MATERIALS USED FOR LIGHTING FIRES.

Figs. 1.



Figs. 2.



City Press, 1, Long Lane: Doudney and Scrymgour.

HADDEN'S PATENT PROPELLER.

(See Engraving, front page.)

(*Abstract of Specification.*)

My improvements are applicable to that description of machinery for propelling vessels, which is known as the screw, and consist in the formation of certain openings or spaces, in the central portions of the thread or threads of such screw, whereby the velocity of the impinging or propelling surface is rendered more equal, and a passage afforded for the water through the centre. In figs. 1 and 2, the same letters indicate the same parts.

Description of Engravings.

Fig. 1 is an end view; and

Fig. 2 is either a plan or side elevation of a screw, with two threads; or, technically, a double-threaded screw. A is a wrought-iron spindle or shaft, to which a rotary motion is to be given by steam or other power, by any known and convenient means; B B, two threads of wrought iron (which are drawn at an angle of 30o), with the spaces or openings, C C C C, cut away, so as to leave the supports or arms, D D D D, and which are keyed to the spindle, A, by means of the bosses, E E E.

I wish it particularly to be understood, that I do not limit myself to the use of a screw with two threads, or to the use of one screw only to each vessel, or to the exact dimensions of openings or spaces in such threads, or to the number of parts left for support; as I have merely described that which I deem best calculated to answer the purpose intended.

RENNIE'S CONOIDAL PROPELLERS.

(*Abstract of Specification.*)

Common paddle-wheels, with their rectangular floats have, on account of the great depth and bulk necessary to be given to them, in order that they may take a sufficient hold of the water, and of the position necessarily assigned to them at the sides of any vessel to which they are applied, a great tendency to increase the rolling of the vessel in heavy seas; present a most inconvenient breadth of surface to opposing winds, and, when they happen to be deeply immersed, offer a degree of resistance which the engines have difficulty in overcoming. And also the common paddle-wheels cause, by the striking of the edges of the rectangular floats upon the water, a strong vibratory motion in the vessel and machinery, and, consequently, a great increase in the wear and tear of both. Now the nature of my invented improvements consists,

Firstly, in applying to the common paddle-wheel a float of a new construction, by which the several defects before mentioned are either obviated, or their retarding influence greatly diminished; and,

Secondly, in substituting for the common paddle-wheel a new propeller of an entirely different construction, which revolves in the water without concussion, and may be fixed at the stem, at the stern, or at the middle, as well as at the sides of a vessel; and may be driven equally well, whether submerged to no greater extent than to be merely covered by the water, or to any greater depth.

Description of Engravings.

Fig. 1 is a lateral section of one radius of a paddle-wheel, fitted with the floats of my new construction; and

Fig. 1.

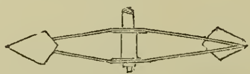
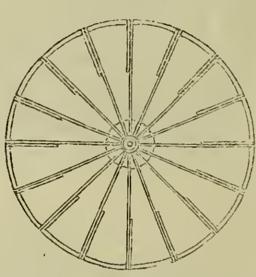


Fig. 2, a side view of the entire wheel. The floats are of a trapezoidal, instead of a rectangular form. I prefer that they should have the form of a trapezium, such as is represented in fig. 1, in which the diagonals are in the proportion to one another of one to one and a half, and that

Fig. 2.



they should be so fixed, that the greatest of these diagonals shall be vertical, as is also shown in the said figure; but they may be of any other form which can result from the bisection of a cone; and whether the faces of the same be plain or convex, or concave, not only is the propelling power to be obtained by floats of this trapezoidal form, greater than what can be obtained from an equal amount of surface

of a rectangular shape, but they enter and leave the water more gradually and smoothly.

Fig. 3 is a side view; and

Fig. 4, a transverse section of the new propeller, by which I propose to do away with common paddle-wheels altogether. It consists of two or more curvilineal leaves or pliers formed as follows, and attached to a shaft or axis:—The curves of which the leaves or pliers should be

FIG. 3.

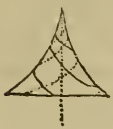


FIG. 4.

formed, are obtained by the descent of a tracer down the surface of a cone or conoid, caused to revolve on its axis. Curves so obtained, have a constantly varying inclination with their axes; and I find, by experiment, that a shaft, with leaves or pliers formed after such curves, revolve in water with a greater propelling power than a shaft with any other sort of curved leaves or curved surfaces. The conoidal mould on which the lines are so traced, may be of any degree of inclination, from the apex to the base; but I prefer that it shall be of such a form, that its obscisses shall increase or diminish in arithmetical progression, while its ordinates increase or diminish in geometrical progression. The screw was employed of old, by Archimedes, to raise water, and it has, in more recent times, been also employed as a means of propelling vessels; but the screw differs altogether from a shaft, having attached to it leaves or pliers of the peculiar curvilineal form, which I have first described, inasmuch as the lines of the screw are obtained by the circumvolution of a tracer round a cylinder, while the lines of my propeller are obtained by the descent of a tracer down the surface of a cone or conoid, caused to revolve on its axis; and in this also, that the re-active force of the curves in the former case is far greater, and, consequently, the propelling power much less than in the latter. To distinguish my propeller from the Archimedian screw-propeller, as well as from all others, and by a name which shall at once indicate the distinctive and peculiar property from which it derives its superior efficiency, I call it the "Conoidal Propeller."

EDWARDS'S PATENT FOR IMPROVEMENTS IN PREPARING AND COMBINING MATERIALS USED IN LIGHTING FIRES.

(See Engraving, front page.)

(Abstract of Specification.)

MY invention relates to a mode of preparing and combining wood or reeds, or wood and reeds with other materials, into suitable bundles for lighting fires, which I call "ventilated faggots;" and, in order to give the best information in my power, I will describe the mode pursued by me in carrying out my invention. In forming bundles of wood, usually called fire-wood, as at present practised, it is customary to tie up several pieces of wood or sticks, or reeds, which, when used, are generally cut or untied to separate the pieces; and should such bundles be used without untying, the pieces of wood, sticks, or reeds, are too closely laid and retained together side by side, to offer a ready means of combustion to each and every part or piece at the same moment; in addition to which, the pieces of wood, sticks, or reeds, being of nearly equal size at each end, they do not offer a ready means of taking light.

Description of the Engraving.

Now, according to my invention, I so combine the parts or pieces of wood, sticks, or reeds, that there is a space between each of the neighbouring pieces, and thus allowing spaces, which may be called flues, and, by this means, introducing drafts or currents of air to rush through, and thereby aid combustion; and, in order to facilitate the first taking fire of each particular piece of wood, stick, or reed, I point or cut away the surface or surfaces, at one end of each piece of which the bundle is to be composed, and, in some cases, where the "ventilated faggots" are desired to light very quickly, I dip the pointed ends into melted brimstone, resin, or other inflammable matter. In combining the portions of wood, sticks, or reeds together, I employ resin, glue, pitch, or other adhesive material, preferring a material which is combustible, and by means thereof, I cause the pieces of wood, sticks, or reeds, to adhere to a strip of paper, rag, wood shaving, or thin wood, string, tape, or other cheap combustible material; each piece of wood, stick, or reed, being caused to adhere at a distance from the other, thus leaving spaces, which, when the whole is combined into a bundle, will offer what I have called small flues for drafts of air to pass through; and I cause all the pointed or sloped ends of the pieces of wood, sticks, or reeds, to be in one di-

rection, and which ends, when made into a bundle, form the lower part or end of the faggot. When I wish to make a cylindrical bundle or faggot, I fold the strip of rag or other material, having wood, sticks, or reeds therein, as above explained, in spiral layers, one around the other, as is represented at fig. 1; or the faggot may be oblong or square, as shown at fig. 2. And I would here remark, that my invention does not depend on the shape or figure of the bundle or faggot, but on the mode of so combining the parts of which each bundle or faggot is composed, that there are spaces between the different parts to produce or permit drafts of air through when lighted, aided by strips of paper, rags, shavings, or other thin combustible matter, which, with the inflammable adhesive matters and the pointed ends, in addition to keeping the parts separated, aid in the general combustion of the faggot. By such means of preparing and combining materials, I am enabled to light fires with more certainty, and, at the same time, with a great saving of fire-wood, sticks, or reeds; as the whole bundle or faggot, when made according to my invention, becomes quickly lighted throughout all its many surfaces, and thus produces a strong fire, which will quickly light the coal or cinder which is placed about the faggot. In using what I have called "ventilated faggots" in lighting a fire, a faggot is placed in the fire-place in its combined state, with the pointed ends of the pieces of wood, &c., downwards; then cinders or coals are to be packed around and above it, and a light is to be applied to the faggot at its lower end, when the whole faggot, or each and every part thereof, will become almost instantly inflamed. I would state, that in some cases I place several knobs of coal or cinder in the faggot, which, being in the direct drafts of the flames in the interior of the faggot, will be quickly in a flame, or red hot, and thus insure the lighting of the fire.

A VISIT TO A POT MANUFACTORY.

No. II.

After the clay has laid in the slip-house a few days, it is removed into a damp place, called the wedging-house, from whence it is fetched by those who work in the clay; that is, pressers and dish-makers, &c.

Previous to its being used, the clay is wedged. This operation is performed in the following manner:—A large piece (say seventy or eighty pounds) is placed upon a bench; the mass is then cut through with a wire, the ends of which the person who is wedging holds in his hands; then, taking up the piece with both hands, which he has thus separated, he throws it down again on the other parts with as great a force as he is able. This operation is continued until the whole lump is perfectly smooth cut at in any direction. This wedging of the clay is an operation of great importance, in order to expel every air-bubble—the beating in the slip-house not being quite sufficient for that purpose; and were the air-bubbles not thoroughly expelled, the ware would be spoiled, because the air, which is contained in the articles, becoming rarified and expanding while in the oven, would force itself out, and, blistering, spoil or very much injure the pots.

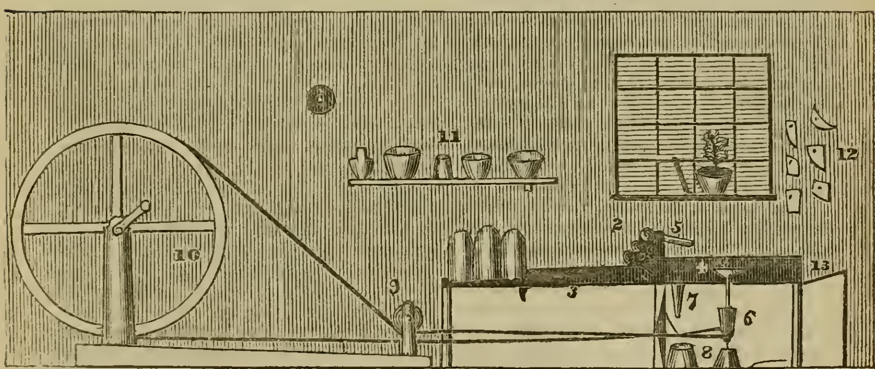
A piece of clay being wedged, it is brought to the thrower—a person who makes circular pieces of ware, such as cups, bowls, basins, mugs, &c. The machine on which these are made, is called the thrower's wheel. A representation of this machine is given in the annexed engraving.

The clay which has been brought to the thrower in large pieces, is first cut into smaller ones by a woman, called the taker-off, formed into small balls, and weighed. In the manufacture of coarse sorts of pots, the balls are not weighed; but for finer sorts they should be weighed, in order that all the articles of one sort may be of a uniform thickness. The thrower takes one of these balls and throws it on the circular board called the block (see engraving). The ball must be placed in the centre; if it is not, the action of the centrifugal force will soon drive it off the block. The machine moves gently while the ball is being placed on the block; it is now moved with considerable velocity, and the thrower, dipping his hands frequently in water, that the clay may not stick to them, fashions the ball of clay first into a long thin column, which he forces again down into a lump; these operations are repeated several times. When the vessel to be formed is of a large size (for cups and other vessels of a small kind), these operations need not be performed above once. They are done for a similar purpose as that of heating and wedging—viz., to expel the bubbles of air. This is of such importance in the manufacture of pots, that every means are taken to render the articles as firm and solid as possible.

The thrower now directs that the speed of the wheel be moderated, and proceeds to shape the vessel. This he does first, by his fingers, after which the inside is smoothed and wrought to its proper shape, and all inequalities, called *slurry*, are removed by instruments made of slate, called ribs. In making several dozens of the same sort of pots, it is requisite that they should all be of the same size. In order to preserve this uniformity of size, pigs, made of wood or iron, are placed as a guage on the edge of the box, in which the circular board revolves, in such a manner that, when the clay is brought to coincide with the guage, the thrower knows that the cup, or whatever it is, has attained its proper size. In this way the thrower forms his different sorts of articles; but it must be observed, that all circular pieces of ware are not made by the thrower. Saucers, plates, &c., are made by pressure—a branch of the pottery art we shall notice shortly. When the thrower has finished the article he is making to his satisfaction, he passes a wire through the bottom part of it, and the taker-off removes it and places it upon a board. When a sufficient number have been placed upon the board, it is removed by a person called the *looker-to-the-ware*, and another board being substituted, the thrower proceeds to fill that.

Considering the numerous operations performed by the thrower in making a single piece of ware, it is surprising how quick the articles are made by an expert workman. Some throwers will make as many as 160 dozens of cups (reckoning thirty-six to the dozen) in one day, which is about thirteen dozens in an hour, or rather more than seven per minute, reckoning twelve hours as a day.

The looker-to-the-ware takes the pots, which the thrower has made, into a large room, where a good fire is kept; or, if it be a fine sunny day, he puts them out of doors on the manufactory to dry, or to get hard, as the workmen call it. The pots, during this process of drying or hardening, require a great deal of attention; for if the articles become too hard, or get harder on one side than the other, they are likely to be broke when they come to be turned. When several boardfuls of ware have become sufficiently hard or dry, the articles are placed one upon the other, and carried into a damp cellar, where they remain until they are wanted by the turner—the person whose operations we shall notice in our next.



Description of the Engraving.

1. Large pieces of clay.
2. Balls formed by the taker-off, and placed there ready for the thrower.
3. Taker-off's bench.
4. The circular board or block.
5. The guage.
6. The spindle, upon the end of which the block is screwed; the lower part of the spindle runs in a step.
7. A spout for conveying away the slurry-water mixed with clay.
8. Vessel for holding the slurry.
9. A pulley for guiding the rope.
10. The wheel.
11. Articles of pottery formed by the thrower.
12. Profiles or nibs.
13. Seat for the thrower.

SPONTANEOUS COMBUSTION.

The occurrence of spontaneous combustion is much more frequent than is generally supposed. It is not confined to the action of chemical ingredients, artificially concentrated, but often takes place in substances apparently the most innocent and inert. A few years ago, much anxiety and suspicion were created amongst the inhabitants of the mountains on the eastern frontiers of France, by the frequent occurrence of conflagrations in the open country, destroying large tracks of the vegetation, which at that time was remarkably dry and parched by the sun. The first fire was attributed to accident; but, after frequent repetitions, it was generally supposed to be the work of malicious incendiaries. A different cause was, however, sought by scientific men; and the result of their researches was, that the whole mischief had been caused by spontaneous combustion. They did not obtain a complete and exact rationale of the process, but the observations and experiments they made, were conclusive enough to remove every doubt of the truth of their assertion. The very praiseworthy exertions of the Corporation of London for the preservation of life and property from destruction by fire, have elicited many valuable suggestions from scientific men; and we trust that every friend to humanity, who possesses any useful information upon the subject, will, without hesitation, communicate it to the Lord Mayor, or to the Committee appointed for the investigation of this important subject. Mr. Abraham Booth, Lecturer in Chemistry, in a letter to the Lord Mayor, remarks on spontaneous combustion as follows:—

"The cases under which spontaneous combustion of animal and vegetable substances will take place, are such as no ordinary sagacity can foresee, nor prudence prevent. In the official reported list of fires, the majority of causes is unknown, while another large portion are only conjectural. The science of chemistry may, however, advantageously lend its aid, and some of its investigations on the subject have been matters of high interest. The most memorable instance on record is that of a series of fires which took place at St. Petersburgh in 1780 and 1781, when a frigate, with several other vessels and houses, were destroyed, supposed to have been the work of an incendiary. A Scientific Commission was appointed by the Russian Government to inquire into the subject, who found that the self-enkindling substances were charcoal and hemp oil. In 1757 the Royal Dockyard at Brest, was nearly destroyed by spontaneous combustion taking place in the rope-yard, and some of the old workmen declared that the same thing had happened some years ago, but that, conceiving it impossible for the bales to take fire of themselves, they had concealed the accident, for fear of being taxed with negligence, and punished accordingly. On Thursday, July 3, 1760, a fire from spontaneous combustion broke out in the rope-yard of the Royal Dockyard at Portsmouth, which caused much mischief. It would be tedious to relate the other various circumstances under which spontaneous combustion will take place, such as with hay, corn, flax, cotton, wool, turf, flour, saffron, and other vegetable substances; rags, oatmeal, charcoal; woollen cloth and cotton goods; roasted coffee and chocolate; roots; bales of woollen yarn or cloth; waste cotton or rags used in cleaning oil, paint, floor-cloth, pyritous coal, &c., &c., although the subject is one of considerable importance in our domestic security."

THE CHEMIST.

NEW COMPOUND OF ARSENIOUS AND SULPHURIC ACIDS.

This new compound has been obtained by Dr. Shafhaeutl from the escaping smoke of copper-calcining furnaces, near Swansea, in South Wales, and is another singular instance where an anhydrous crystallized body is deposited under the presence of water only; and is a remarkable proof of the unlimited number of different forms of combination, which might be produced, even in organic nature, by bringing chemical substances in contact under varying circumstances. The copper ores smelted in South Wales are, for the greatest part, copper pyrites, mixed with iron pyrites, grey copper ore, &c.; in fact, a mixture in which the sulphurets of copper, iron, arsenic, antimony, cobalt, nickel, zinc, and tin, are invariably found together. The sulphur and arsenic escape from these ores during the calcining process, as sulphurous and arsenious acids, and have been found to destroy all vegetation for miles around the copper works, without affecting animal life in the slightest degree. By bringing the escaping fumes in contact with steam, and forcing it through burning charcoal, or subjecting it only to a great pressure in contact with steam, the new solid compound was deposited on the cool surfaces of the chambers connected with the calcining furnace. It

is deposited in beautiful crystallized leaves or tables, perhaps belonging to the same class as Wohler's dimorphic modification of the crystallization of arsenious acid, the regular form of which belongs to the octahedron, and is found to consist, in 100 parts, of

68.250	arsenious acid
27.613	sulphuric acid
3.029	protoxide of iron
0.420	oxide of copper
0.656	oxide of nickel
99.998	

Corresponding to

51.741	metallic arsenic
11.095	sulphur
2.339	iron
0.336	copper
0.516	nickel
33.971	oxygen
99.998	

These crystals attract moisture from the air with great rapidity and with evolution of heat, corroding animal and vegetable substances as powerfully as concentrated sulphuric acid. Their taste is pure, but powerfully sour, similar to sulphuric acid, and, dissolved in water, the remainder of 100 parts of these crystals is 17.436 grains only. The shape of the crystals is perfectly retained, only their appearance is changed from transparent into opaque. Their chemical composition was found to be,

16.778	grains of arsenious acid
0.656	oxide of nickel
17.434	

What the water had dissolved, consisted of

51.472	arsenious acid
27.613	sulphuric acid
3.029	protoxide of iron
0.420	oxide of copper
82.564	grains.

One of the remarkable changes during the formation of this compound, is the conversion of sulphurous acid into sulphuric acid, as well as the presence of iron, copper, and nickel, in a deposit from gaseous matter. No other definite compound of arsenic acid with another acid seems to be known, except those with the organic tartaric and paratartaric acids.

Why is the life of insects the briefest of all existence? Because the males rarely survive the inclemency of the first winter, and the females die after having deposited their eggs.

ON THE RELATION OF FORM TO CHEMICAL COMPOSITION.

(Read before the British Association, by Dr. Shafhaeutl.—From the Athenæum Report.)

The author stated that he had, in a former communication, given a new method of procuring graphite, in which it was also shown, that all graphites owed their origin to the operation of the same causes; namely, the contact of bitumen (or any similar substance) with a silica, under a certain limited degree of heat; it was farther maintained, that the compound nature of graphite might be satisfactorily demonstrated, by subjecting it to the action of hydrofluoric acid, which, combining with the silicon, liberated the carbon of the graphite as a hydruret, which was then consumed in the flame of a lamp. The object of the present paper was, to explain the circumstance under which certain modifications of form take place in this peculiar substance (as also in others generally considered to be elementary), and to prove their connexion with changes of an entirely chemical nature. A beautiful specimen of a formation of graphite was exhibited to the Section, obtained from the Neath Abbey Ironworks, in South Wales; it appeared to be composed of an infinite number of foliated scales overlapping each other, after the manner of the slates of a roof, each scale being so thin, as to be agitated by the slightest breath of air. A second specimen was exhibited of a graphite leaf, where it appeared as a globule of much greater size, the laminated structure still, however, existing in beautiful development. In a third stage, the scaly structure disappeared, the globule having assumed a more porous and coke-like form. Dr. S. having premised an objection to any explanation of these curious changes of form, founded merely upon molecular alterations, proceeded to detail certain experiments, from which he deduced conclusions of an interesting and important nature. The discovery of a new mode of decomposing crystallized graphite, by heating it in concentrated boiling sulphuric acid, and adding a little concentrated nitric acid (see a description in the *Phil. Mag.* xvi., xvii.), afforded a series of singular and instructive phenomena. After the evolution of binoxide of nitrogen had ceased, each scale of graphite was converted into the globular substance before described; its external metallic lustre remaining unchanged, but its bulk so greatly enlarged, that what before appeared a single scale, became, by the separation and division of its component la-

minæ, a thick spongy tissue, capable of being restored to its former compressed foliated form, by the pressure of the finger nail. That this change of form, however, was not merely a mechanical effect, appears from the following experiment:—Graphite scales having been repeatedly treated with hydrochloric acid, washed, and again digested in a strong solution of caustic potash, in order to remove all possible mechanical admixtures of iron, silica, and alumina, were then subjected to the process above described; the evolution of binoxide of nitrogen having ceased, an equal quantity of water was added to the mixture; immediately there succeeded a rapid evolution of bubbles from the globules of graphite, which at first lay at the bottom of the fluid; becoming lighter, as this evolution of bubbles proceeded, they gradually rose to the surface, when the gas immediately ceased to be evolved; the acid then, or the graphite, must have been combined with hyponitrous acid, which, being decomposed by the water, was disengaged as binoxide of nitrogen. The globules, when washed, dried, and weighed (at first weighing but 2.01 grs.) *had gained* 5.02 grs. in weight. Being then put into a flat covered dish of brass, and balanced accurately, the cover was removed, the globules immediately lost weight, and so rapidly, that in merely removing them from the dish, 0.18 grs. were lost; the dish was covered with a dew, apparently acid, as it acted on the brass. These globules, heated on paper until it became slightly tinged with yellow by the heat, now disengaged dense fumes, the paper being streaked with a blackish-coloured smoke, where it was in contact with the graphite; 2.30 grs. were lost during this process, which, being repeated a second time, they were found to have lost 2.25 more. Finally ignited in a platinum crucible, dense fumes, without any perceptible odour, escaped, the weight of the globules being reduced to 1.86 grs. After which, no farther reduction took place during ignition for half-an-hour in the open air. The total loss of the two grains thus experimented upon with the acid, was 6.96. In a paper by the author (see *Philosophical Magazine* cited above), this loss was attributed to evolution of carbonic acid during this conjointed action of the acids; but it would appear from the last experiment, that there is formed a compound of sulphuric acid, nitric acid, carbon, hydrogen, and oxygen, volatilized only at high temperatures. The question here arises, how can the rapid loss of weight be accounted for? During the previous drying process, which was conducted at 212°, the loss of water must have been accompanied by a change of chemical composition, and the new compound, by attracting water or oxygen when in the pan, must have formed an extremely volatile combination, evaporating as rapidly as it was formed. By a repetition of this treatment with the acid, graphite in the third stage, as before described, was obtained; the metallic lustre was entirely lost, as also the laminated texture; it now appearing as a porous mass, resembling coke, and no longer capable of reduction to its original foliated state by pressure, having undergone a decided chemical change. The acid solution deposited at once a copious precipitate of silica and alumina (slightly tinged by oxide of iron), upon the addition of ammonia to neutralization. A similar precipitate was obtained from the acid of the first experiments, but less in quantity, and requiring a longer time for its operation. Thus it would appear, that the abstraction of silicon and the change of physical properties of graphite, are corresponding and mutually connected phenomena.

(To be continued.)

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 18, R. D. Grainger, Esq., on the Nutritive Processes in Animals. Friday, November 20, R. D. Grainger, Esq., in continuation. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, November 19, W. H. Woolrych, Esq., on War. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 16, J. Smith, Esq., on the Acquisition and Communication of Knowledge. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 18, Mr. H. Wiglesworth, on Electricity. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, November 17, Master Johnson, on Botany.

TO CORRESPONDENTS.

W. H.—*Chlorine (from* klorine) *is derived from a Greek word, signifying green.*

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THE

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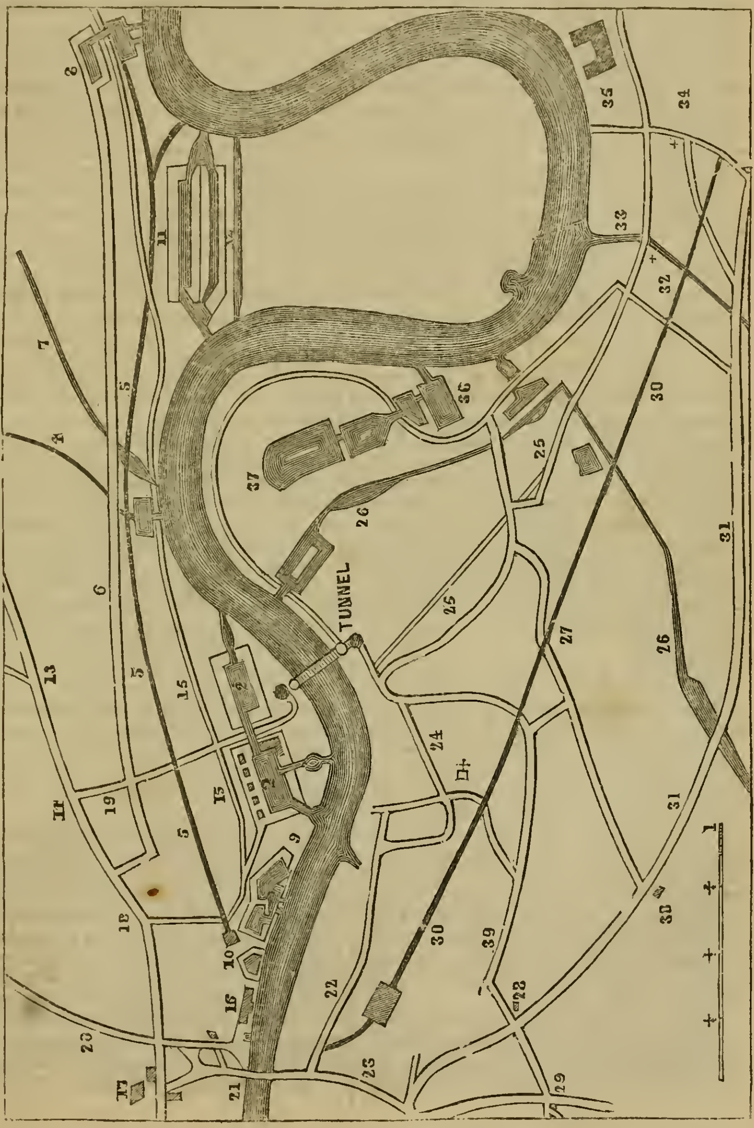
THE THAMES TUNNEL.



 City Press, 1, Long Lane: Doudney and Scrymgour.

THE THAMES TUNNEL.

(See Engraving, front page.)

We feel it to be a duty we owe to the public, to express our gratification that this great national work will shortly be completed. The ears of most of us are so accustomed to the sound of the Thames Tunnel, that it has lost the charm of novelty; but could such a wonder be at once presented to us without our having any previous knowledge of its existence, we should, no doubt, flock by thousands to make sure that there really was a passage for carriages and foot passengers under the bed of a great river, over which thousands of vessels were daily passing and repassing; but we are not now left to mere speculation on the subject.

The effect on foreigners is such as we have attempted to describe; they have scarcely arrived in London, and deposited their portmanteaus at some hotel, but almost the first inquiry is for the Thames Tunnel; and off they go to gratify their curiosity, and to admire the skill and perseverance by which such a wonder has been accomplished; and we feel convinced that, could a whole nation of foreigners be at once transported to our country, the Thames Tunnel would be so crowded, that those wishing to see it would long have to wait for a turn. Is it not, then, surprising, that so many of our own countrymen remain in ignorance of the nature of this great work? Should we not, as a nation, be proud of it? It is, doubtless, the greatest work of art ever accomplished. For we may say, that it *is* accomplished, the excavation having been carried ten feet beyond high-water mark under Wapping Wharf.

The farther progress of the work in the Tunnel itself, is, for a time, suspended. and the workmen are now sinking the shaft to obtain access to the Tunnel on the Wapping side. This affords an excellent opportunity for the examination of the shield, well worthy the attention, not only of scientific men, but of all persons possessing the desire to see a piece of mechanism, by means of which so great a work of art has been carried on. We have no hesitation in saying—and, we believe, most scientific men will agree—that the chief merit of the engineer, who, by the accomplishment of this great national work, has surpassed all others, lies in the formation of this shield.

It may, perhaps, be as well to observe, for the information of those who have hitherto paid little attention to the subject, that this shield is a massive iron framework, the size of the excavation; in which the workmen stand and cut away the soil; the frame-work being in separate compartments, is moved forward, as room is made for each division. Thus it supports the top and sides of the newly-formed excavation. Hitherto the public have not been able to inspect the shield, as they could not approach it when the work was going on; had they been permitted to do so, it would not have been possible for them, while the mud and dirt were flying about, and the water oozing through in all directions, to form a correct idea of it; but now they may inspect it at their leisure without interruption. Not only are we to consider the grandeur of the work and the difficulty of the excavation, but it must necessarily prove of great utility, by establishing a communication between the parts of our great metropolis, where extensive manufactories are established, and almost in the centre of our unparalleled commerce. Having on the one side the London and the St. Katherine's Docks, and on the other side the grand Surrey Canal and the Commercial Docks. In such a position, what must be the interchange of weighty articles and people from side to side, now subjected to the inconvenience of passing round, about four miles, by London Bridge, or of embarking—crossing amid thousands of vessels, passing and repassing—encountering the dangerous swell produced by the numerous steamers; and, after accomplishing this troublesome passage, they are then subjected to the annoyance of landing on a muddy beach or upon dirty stairs. When the Thames Tunnel is completed, they will be enabled to pass on dry ground under the bed of the river, and the heavily-laden waggons will no longer be obliged to make the route referred to: in fact, it would be quite impossible to enumerate the extent and number of advantages that must result from this great work; an idea of which may be formed by reference to its position as pointed out in the annexed plate.

A project for a tunnel was put forth in 1799, but soon abandoned, which was followed by an attempt to form a tunnel from Rotherhithe to Limehouse in 1804; and in consequence of the great difficulties met with, it was suspended for a time; but at length a small drift way was carried under the river to the extent of 923 feet, being within 150 feet of the opposite side, when the farther progress was considered impracticable, and the work, consequently, abandoned. Other plans for a tunnel were proposed, but not brought to maturity.

The present position of the Tunnel may be considered as the only one that could well be selected, without interfering with great establishments on either bank of the river.

In 1824, Mr. Brunel's plan for constructing, on a useful scale, a double and capacious road under the Thames, was commenced by building a shaft of brickwork, forty-two feet high, three feet thick, and fifty feet in diameter, at about 150 feet from the edge of the wharf; in which position this shaft was sunk, by excavating the soil within, by which means it sunk through a bed of gravel and sand, full of land water, forming a quick-sand, which had presented much difficulty to a former undertaking. The water and earth from this shaft were raised by means of a steam-engine erected on the top of it: this being completed, and a smaller shaft sunk as a well, the Tunnel was commenced at a depth of sixty-three feet from the surface; the engineer being prevented from going as deep as he otherwise would have done, by the assurance, that he would come in contact with a bed of sand. He was unable to obtain a thicker stratum between the river and upper part of Tunnel, by which it seems probable, that the inundations which interrupted the work for a long time, and occasioned a vast expense, would have been avoided.

The excavation made, is thirty-eight feet broad, and twenty-two feet six high. The shield, already alluded to, by which this extensive excavation has been effected, consists of twelve large iron frames, lying close together, like books on a shelf. These frames are twenty-two feet high, and about three feet broad; they are each divided into three stages, thus forming thirty-six places for workmen. This shield not only serves for the excavators, but also for the bricklayers, who carry on their work at the same time. Towards the head and foot of the shield, there are horizontal screws attached to each of the divisions, and screwed so as to press against the finished brickwork, thus forcing the division forward as the workmen clear a way for it. There is also a moveable stage, with two floors, for the miners and bricklayers to place their material. A mass of brickwork, forming two arches, is carried on simultaneously with the excavation, having a middle wall of four feet solid work, with a succession of arches in it, forming a communication between the two carriage ways.

The access for carriages will be by circular road-ways, 200 feet in diameter, the declivity of which will not exceed four feet upon the hundred. There being two carriage roads, the carriages will pass through one road in going one way, and the other when going the contrary way; so that there is no danger of contact. The foot passenger will also have the advantage of the shafts; one of which on the Rotherhithe side was the first sunk, and has long been used.

Description of Engraving.

1. Tunnel.	20. Bishopsgate Street.
2. London Docks.	21. London Bridge.
4. Regent's Canal.	22. Tooley Street.
5. Blackwall Railway.	23. Borough.
6. Commercial Road.	24. Jamaica Row.
7. Limehouse Cut.	25. Deptford Lower Rd.
8. East India Docks.	26. Grand Surrey Canal.
9. St. Katherine's.	27. Blue Anchor Road.
10. Tower.	28. Bricklayers' Arms.
11. West India Docks.	29. Elephant and Castle.
12. City Canal.	30. Greenwich Railway.
13. Road to Hackney.	31. Kent Road.
14. Mile End.	32. Deptford.
15. Ratcliffe Highway.	33. Creek Bridge.
16. Custom House.	34. Greenwich.
17. Bank.	35. Royal Hospital.
18. Aldgate	36 & 37. Commercial Docks.
19. New Road.	

THE BRITISH PATENT LAWS.

We are constantly receiving applications from inventers for advice to enable them to secure to themselves the advantages to which they are in justice entitled, but which the law withholds from all who are not prepared to purchase its protection at an exorbitant price. We extract the following from a correspondent (A. Z.):—

" I have invented several things, such as a carriage upon an inch scale, of the Birmingham pattern, that will run the sharpest curve that is upon any railway, without that friction upon the edges of the rails—the hind wheels always running in the same track as the fore ones make, turning either to the right or left. Each wheel is firmly fixed upon the axle, and yet they can run, some backwards and some forwards, at the same time, if required; so that the outer can travel the outer circle with perfect ease, while the inner ones stand comparatively still; will run a circle of twenty-four inches, either on the rails or upon the top of a table, without the smallest difficulty; the springs so placed as to do all the work of the present carriages, and only half the weight of metal now used, so that the passengers ride just as easy again as they do at this time. I have attached to the carriage a self-acting break or clog for the wheels; so that when a collision takes place, running down the engine, it cloggs the wheels of as many

carriages as have it fixed to them; then, as soon as they feel the draft of the engine, it relieves itself of the same. It is supplied with a small apparatus to make its own announcement at any place that may be thought expedient, without the engineer or passengers knowing anything about it. Say a train is expected from Birmingham at a certain time, just time for the policeman to get his breakfast; but, by some means, it arrives ten minutes sooner, and before it reaches the tunnel, Primrose Hill, half-a-mile or a mile, will make its own announcement in the room where the policeman is sitting, at Chalkfarm depot. My carriage is so constructed, that should there be anything lying upon the rail that would throw the carriages off, it would still keep on. I have also a rail and a chair for ditto, to lay in upon sleepers, that lies much firmer than any I have yet seen; and no engine upon the Birmingham line or carriage will run off; and, when worn for ten years, may turn it upside down, and wear a new side. Only one thing more I will mention at this time, least you think I am making false statements; but this I will not do if I know it. I am now putting an apparatus to one of my carriages, that, if the guard of the train is allowed to ride upon the carriage next to the tender, and seeing any danger, he can, in one moment, detach the engine and tender from the train, and stop the four or all of the wheels of the first carriage, and then the self-acting break will stop the rest. These little things I would gladly give up to any railway company for a permanent situation."

It cannot be expected that every communication of this nature, speaking only of results, without exhibiting the means of obtaining them, should occupy the columns of the "Mechanic;" but, at the same time, it should be recollected, that useful mechanical inventions, however profitable they may be to the projector, are equally, or more so, to the community at large. It is undeniable, that the commercial prosperity of this country has been materially advanced by such inventions; and it is equally true, that many of them have emanated from men who possess but a scanty share of scientific knowledge. Genius and industry can achieve great things; and their suggestions ought not to be discarded or contemned on account of their not being expressed in the elegant diction of science.

The oppressive Patent Laws, of which we now most especially complain, are but a branch of that poisonous upas tree whose deadly shade withers the tender plants of unprotected merit and genius. The great fundamental evil is the undue favour accorded to wealth; the powerful are protected, and the feeble are left defenceless; wealth is rewarded and poverty is abandoned or plundered. There is scarcely a lucrative place in any public office, which may not be obtained by money and intrigue; and appointments and preferments in the army, are bought and sold as shamelessly as cattle are bought and sold in a public market; so that any rich booby, who is qualified as a dandy and a sycophant, can, in a few hours, become a military commander, to the manifest prejudice and injury of those whose claims are founded only on merit and faithful discharge of duty. We shall at present, digress no farther from our main object; but we are anxious to show, that inventers are not the only class unfairly dealt with—in order to induce those who have no immediate interest in the establishment of equitable patent laws, to unite their exertions with those of the more directly interested, and thus acquire a claim of reciprocal aid, when their own immediate interest shall require it. We appeal for assistance to every mechanics' institute, and every scientific association in the kingdom (except the Royal Society, which has sworn to give no opinion upon anything); and we implore all well-wishers to their country, and all friends of justice, to examine the subject, and be prepared, when the time shall come, to join in petitioning the Legislature for redress. We are far from desiring that wealth should be deprived of its legitimate influence; when fairly acquired, and securely held, it is power in itself, and needs no assistance from the Legislature to increase its weight. If a man be but rich, says Democritus (Robert Burton), all men's eyes are upon him; "God bless his good worship! his honour! Every man seeks his acquaintance, his kindred, though he be an aufe, a ninny, a monster, a goose-cap, *uxorem ducat Danaen*, when and whom he will; *hunc optant generum, rex et regina*—he is an excellent match for my daughter, my niece, &c.; every man is willing to entertain him; he sups in Apollo wheresoever he comes. What preparation is made for his entertainment! Fish and fowl, spices and perfumes, all that sea and land afford. What cookery, masking, mirth, to exhilirate his person! What dish will your worship eat of? What sport will your honour have? Hawking, hunting, fishing, fowling, bulls, bears, cards, dice, cocks, players, tumblers,

fiddlers, jesters, &c.—they are at your good worship's command." So it ever was; and while human nature remains what it is, so it ever will be; and all this, and a thousand secret intrigues which money alone can conduct, belong to wealth, and need no exclusive and oppressive laws to secure them. Let them enjoy all the good things, the adulation, and sham friends, that riches can purchase; they are welcome to them; but do not take from poor industrious men, that which in justice belongs to them. We ask no favour, we demand justice; and, sooner or later, we shall have it. Where is the man that will lay his hand on his heart, and say that he believes it to be right that no talent, no invention, however valuable it may be in itself, should be rewarded or protected, if the inventer cannot raise 350*l.*, and allow himself to be robbed of all that money? No man of common sense and common honesty can do it. The simple, honest working man, does not covet the estates of the magnates of the land; he knows that he is as happy, or happier than they are, if he can but "keep the wolf from his door." A man is as wet in a bath, as he would be if plunged into the ocean; and if he has something that he likes for dinner, and plenty of it, he is as well fed as my Lord Mayor or my Lord Melbourne. Pyrrhus would first conquer Africa and then Asia, *et tum suaviter agere*—and then live merrily and take his ease; but when Cineas, the orator, told him he might do that already, *id jam posse fieri*, rested satisfied, condemning his own folly. We are only proclaiming the sentiments of the honest mechanics of this country, when we declare that we neither ask nor desire any favours from the hands of the rich; we demand justice, and WE WILL HAVE IT, if the supineness of those for whose benefit it is claimed, does not induce indifference or opposition in another quarter.

THE CENTRIFUGAL ESCAPEMENT.

To the Editor of the Mechanic and Chemist.

Sir,—I am a constant reader of the "Mechanic and Chemist;" and when your last week's Number came to hand, I was very much surprised to see an invention of mine (namely, the "centrifugal escapement"), with the name of "J. Paterson" attached to it. Now, Mr. Editor, allow me to inform you most respectfully, that this "J. Paterson" did not invent the centrifugal escapement, nor any part of it. The facts of the case are these:—J. Paterson was in my employment at the time I was constructing the first model of the invention, and, as he worked beside me in the same apartment, I was obliged to let him see it, and had his promise that he would keep the secret. You see how he has kept that promise. Since then, the invention has undergone many improvements which he knows nothing of; and the objection that you, Mr. Editor, have mentioned in your note at the end of his description, is entirely done away with. I would have here given a full description of the clock in its present improved state, but I have sold it; and as it is now the property of others, it would not be fair to do so without their concurrence. Hoping that you will insert this in your next Number, I remain yours respectfully,

A. Bain.

35, Wigmore Street, Cavendish Square, Nov. 10, 1840.

[Mr. Bain describes his invention as follows:—"This time-keeper is made upon the principle of centrifugal force and gravitation, acting in opposite directions to each other upon two revolving balls, which are seen (within the ring) upon the top of the clock. The first peculiarity of this clock is, that the time-keeping or regulating parts revolve continually in one direction in a circle around their centre; thereby imitating more closely the motions of the heavenly bodies, from which our time is taken, than either the pendulum or balance, these having vibratory motions. Secondly, the balls or regulating parts are quite detached from the mechanism of the clock, except about two seconds each minute when they are receiving their impetus, thereby reducing the friction to less than one-tenth of ordinary escapements. Thirdly, there is a principle in this escapement itself, whereby the balls will only take one certain quantity of power from the main-spring each minute, thereby preventing any irregularities that might be in the main-spring, or of the clock mechanism, to affect its going." This allusion to the motions of the heavenly bodies, is mere *ratiocinatio verbosa;* a discourse upon words, unconnected with facts. In our former remarks upon this escapement, we said that it could not produce a true measurement of time; we say so still, and will give our reasons for maintaining that opinion. In examining the construction of any mechanical combination or machine, it is expedient to divide the investigation into two distinct parts: first, considering the principle, and calculating its result as it would be, if unaltered by imperfections in execution, and other external influences; and then, esti-

mating the amount of external impediments, and the means of compensating or counteracting their effects. Now it will be seen that the centrifugal escapement is dependent upon friction and other essentially variable and uncertain elements for the performance of its proper functions; and the motion of the machine is subject to corresponding variation with every alteration which may, and unavoidably will take place in those inconstant actions. Suppose all friction, atmospheric resistance, and other obstacles to be removed; the balance, once put in motion, would continue to revolve uniformly for an indefinite period, and the detent would never be liberated, and, consequently, the motion of the clock would be arrested; but introduce the friction on the pivots of the balance, the resistance of the air, &c., and the action of those impediments will retard the velocity of the balance till the weights descend and liberate the detent, which confines the maintaining power. It is clear, that the time employed in producing this given quantity of retardation, is wholly dependent on the intensity of the resistance; and the agency of such uncertain elements is utterly inadmissible in the construction of an accurate timekeeper. A clock upon this principle is now exhibited at Messrs. Hunter and Edwards', Cornhill, London.—Ed.]

THE CHEMIST.

ON THE RELATION OF FORM TO CHEMICAL COMPOSITION.

(Concluded from p. 240.)

In farther proof of the necessary connexion of silicon as a chemical combination, essential to the existence of the scaly metallic lustre of graphite, it will be found that, by repetition of the same experiments, the globules ultimately disappear, and the remaining solution in acid neutralized by ammonia, deposits only flaky silica, with traces of oxide of iron. On observing attentively the specimen of graphite, as found in its natural state, and comparing it with those treated with acids and alkalies, also exhibited, it appeared that the scales, before being operated on, had a dirty greyish appearance, described as owing to their being covered with spots, consisting of microscopic six-sided flattened prisms of silicate of iron; the matrix of this graphite formation, in the blast-furnace cinder, essentially composed of bisilicate of lime and alumina, deriving a yellowish tint from a slight admixture of sulphuret of calcium, with a trace of sulphuret of potassium. Scales of very different density may be separated, the thinnest unaffected by the magnet, the thicker ones decidedly so; those in the middle of the mass thicker and stiffer, not easily broken, and showing a shining black fracture, like that of anthracite, form a variety of graphite, in which silicon and iron are greatly predominant, developing, when treated with hydrochloric acid, a fetid hydrogen, characteristic of cast iron, and separating at the same time yellow flocks of silica and alumina. Dr. Schafhaeutl then proceeded to point out an analogy between the formation of grey iron in the blast furnace and that of graphite; namely, that the same chemical conditions occur during the change of white iron into grey; this takes place after having descended through the furnace, and reached the stratum of slag covering the melted metal; the slag being an earthy bisilicate (in coke furnaces, approaching to a trisilicate), and containing a small quantity of protoxide of iron. As silicon is found in graphite only in very small quantity, it has been considered an accidental impurity, just as the small quantity of hydrogen retained by charcoal, sulphur, &c., has been considered an impurity; but as these foreign matters can by no chemical means be separated, without destroying the state in which graphite, charcoal, and sulphur exist, it must be inferred that such admixture is essential to their existence in that state in which they ordinarily appear. Quitting now the individual consideration of graphite, the author extended the principle here argued to certain other substances, considered generally as simple bodies. For example, sulphur obtained by the decomposition of sulphurets by acids, is white in colour, and invariably combined with a stable quantity of hydrogen. But, obtained from hyposulphites, it is as invariably yellow, and the presence of free hydrogen in the slightest quantity, bleaches the precipitate. The known case of sulphur precipitated under the presence of sulphuretted hydrogen, and cautiously mixed with metallic copper in its utmost state of minute division, being found to combine directly, evolving a dull red heat, has been considered an exception to the law, that no two dry bodies unite without the intervention of a third; but sulphur, precipitated from hyposulphites, will not thus combine, nor will pure sulphur, though subjected to the minutest division possible. The same sulphur, however, brought into contact with hydrogen, under a pressure of four atmospheres, and then quickly mixed, is found

to combine, as in the first instance; but if exposed to the air, its power of combination is again lost: thus, a third body is proved necessary here, as in all cases. And farther, the author doubted if one of the two different crystalline forms of sulphur is not owing to the presence of hydrogen, which he found to be in combination with it in a very perceptible quantity. These peculiar forms of combination, where a few atoms of one body are combined with a high number of atoms of another, may be considered, perhaps, as forming a class of compounds intermediate between the inorganic and the higher organic compounds; thus, the compounds of arsenic acid form a very striking example. In the subarseniate of iron, fifty atoms of iron are combined with only three atoms of arsenic acid and seventy-five of hydrogen. So again, twenty-four atoms of arsenic with one atom of sulphuret of potash in sulph-arseniate of potash. By gra. dually passing from compounds of inorganic chemistry to those of organic chemistry, we find diacetate of copper with water; forty-eight atoms of oxide of copper combined with only one atom of hydrogen, and twelve atoms of water. And, finally, in the field of organic chemistry itself, we have, for example, margaric acid, composed of sixty-seven atoms of hydrogen, thirty-five carbon, and three of oxygen only. In the oleic acid, 120 atoms of hydrogen are combined with seventy of carbon and five of oxygen; in the stearic acid, 134 atoms of hydrogen with seventy of carbon and five of oxygen, &c. The author hinted in his paper in the *Philosophical Magazine*, that the principal circumstance which tended to produce compounds of such multiplicity of atoms, or, in fact, organic compounds, was the separation of the molecules of bodies brought into action by the capillary powers of the vessels of organic structures. It was probable that the chemical action of these separated molecules must be a different one, from their action, when arranged into one definite form; and, as a proof that once-received laws of affinity were exhibited only under peculiar circumstances, he directed the attention of the Section to H. Rose's compound, formed by direct combination of 29.97 per cent. of ammonia, with 70.03 per cent. of sulphuric acid, which ought to have produced anhydrous sulphate of oxide; but after combination, neither sulphuric acid nor ammonium could be detected in the compound. The same chemist found combinations of anhydrous sulphuric acid with the chlorides of ammonium, potassium, sodium, and the nitrate of potash. According to the laws of affinity, for example, in the last case, the nitric acid ought to have been displaced, decomposed, and driven away by the more powerfully-acting sulphuric acid; but no tendency whatever was shown to the displacement of chlorine or nitric acid, and new compounds, different from all hitherto known, resulted. As no combination of anhydrous sulphuric acid took place at all with oxide of calcium, chloride of barium, or chloride of copper, he concluded, that these above-mentioned combinations were formed only by replacing one double atom of hydrogen water or chlorine, in order to form a bisulphate of potash, soda, or ammonia. The author seemed to believe, that there existed two different states of chemical combination: the first in which the chemical forces of molecular attraction were acting only according to the relative quantities of matter; the second, where, under the always catalytic presence of a third, the elementary substances arranged themselves, separating in groups according to the resultant electric forces of the centres of action created by the above-mentioned presence of a third, acting differently on the different molecules of bodies in contact, in a somewhat similar way as a solution, which does not crystallize, unless the molecular equilibrium of the liquid is disturbed. The first state of chemical combination might, perhaps, have some distant relation to Dumas's law of types; the second state, a mere consequence of the first, would be represented by Berzelius's electro-chemical combination. The author, at the same time, referred to Prof. Graham's admirable papers, in which the Professor had so distinctly pointed out the great and *peculiar* part which matter performs in chemical solid combinations, and remarked, that during all chemical combinations where a third body is separated, the precipitation only would take place, when a certain quantity of water combined with the body to be precipitated, which water separated in the relation to the separation and consolidation of the precipitate only, and could be driven away from it only by applying a red heat.

MISCELLANEA.

Novel and Extraordinary Phenomenon.—Accident has led to the discovery, that the steam which escapes from the boilers of steam-engines, in many cases develops or gives out great quantities of electricity. About a fortnight since, the engine-man at a stationary steam engine on a railway in the neighbourhood of Newcastle, hap-

pening to have one hand in a copious jet of steam, which escaped from an accidental aperture in the boiler, whilst he applied his other hand to the lever of a safety-valve, experienced an electric shock. This led to the discovery, that electricity was given out by the steam with great rapidity, and might be collected as from a powerful electrical machine. It has been ascertained, moreover, that the phenomenon does not arise from any circumstances peculiar to the boiler in which it was first observed; for in many other boilers, which have since been tried, the steam has been found to develop electricity very copiously. The subject is being followed up here by experiments, and has been brought under the notice of some of the most scientific men of the day. It is not unlikely that the newly-discovered phenomenon may lead to important results, in advancing our knowledge of the nature of the subtle and mysterious fluid, and form an era in the history of electrical science.—*Northern Star.*

Railway Accidents.—As the number and extent of railway lines of road increase, it must be expected that a proportional increase of accidents will take place, unless some remedy be discovered that will insure safety, either by mechanical construction or improvement in the administration and selection of the persons employed. A correspondent of the *Railway Times*, alluding to a suggestion for placing a truck at the back of every train, as a protection against collisions, recommends, as an additional security, " a shield of adequate strength, having attached to each side of it one or more coiled springs, like the mainspring of a watch. This machinery to be affixed to a luggage or goods-waggon at each end of the train of carriages. The effect of this, I imagine, must be to exhaust the force of any collision, in a circular direction, and prevent the impulse on the carriages. Perhaps if you publish this hint to the mechanical and railway world, something may arise out of it. This would be too cumbrous as a defence to each of the carriages in the train; but something more might surely be done, by means of springs, than is done, to mitigate the concussions of the carriages with each other, when any obstacle occurs within the line of the train itself, as in the Hull and Selby case. No care on the part of the management can prevent accidents arising from the negligence, perverseness, or indiscretion of voluntary agents, nor always from other causes. No mechanical contrivance, therefore, ought to be neglected, to prevent the lamentable consequences of such accidents when they do occur."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 25, R. D. Grainger, Esq., on the Nutritive Processes in Animals. Friday, November 27, R. D. Grainger, Esq., in conclusion. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, November 26, Mr. Whitney, on the National Varieties of the Human Species. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 23, Mr. O. Vidler on the Comic Literature of England. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 25, Mr. James Smith—Discussion: Is Novel Reading Commendable? At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, November 24, Mr. C. Lane—Is Development the Ultimate Aim in Education?

TO CORRESPONDENTS.

S. G. *may see Simon's blocking machine at No. 14, West Row, Regent Street. It is a French invention, patented in England as well as in France. In the opinion of respectable manufacturers, the fronts blocked by this machine, are superior to those made by the old manual process.*

T. Hedgcock.—*The drawing is not sufficiently distinct to insure an accurate execution of the engraving. Diagrams of this kind should be drawn of the proper size, and in every respect as they ought to appear in the engraving.*

A Subscriber *may procure the circular steel plates, similar to those used for circular saws, at any of the tool-shops where Sheffield goods are sold, but they must be made to an especial order.*

L. S. *will find instructions for taking a cast from the human face in No. 86, N. S.*

W. C.—*The works he mentions do not contain the tables of logarithms he requires. We will endeavour to supply him with the information he desires.*

G. A.—*Seidlitz powders may be made as follows:—Three drachms of Rochelle salts; twenty-six grains of carbonate of soda; twenty grains of tartaric acid.*

S. C., Weymouth.—*The letter he refers to has not been received; if he will favour us with another communication, we shall feel obliged.*

G. L.—*The copies of medals obtained by the electrotype from a solution of the sulphate of copper, are compact masses of copper, and may be treated in the same manner as if cast or stamped.*

A. B.—*Spirits of wine is preferable to oil for burning in a lamp used only for the production of heat, as it produces no perceptible smoke.*

A. S.—*A very small power is sufficient to prevent a person from sinking in the water; a cubic foot of air has a power of buoyancy exceeding 60 lb.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 121, NEW SERIES. | SATURDAY, NOV. 28, 1840. PRICE ONE PENNY. | No. 242, OLD SERIES.

THE WINDOW WHIRLIGIG.

FIG. 1. FIG. 4.

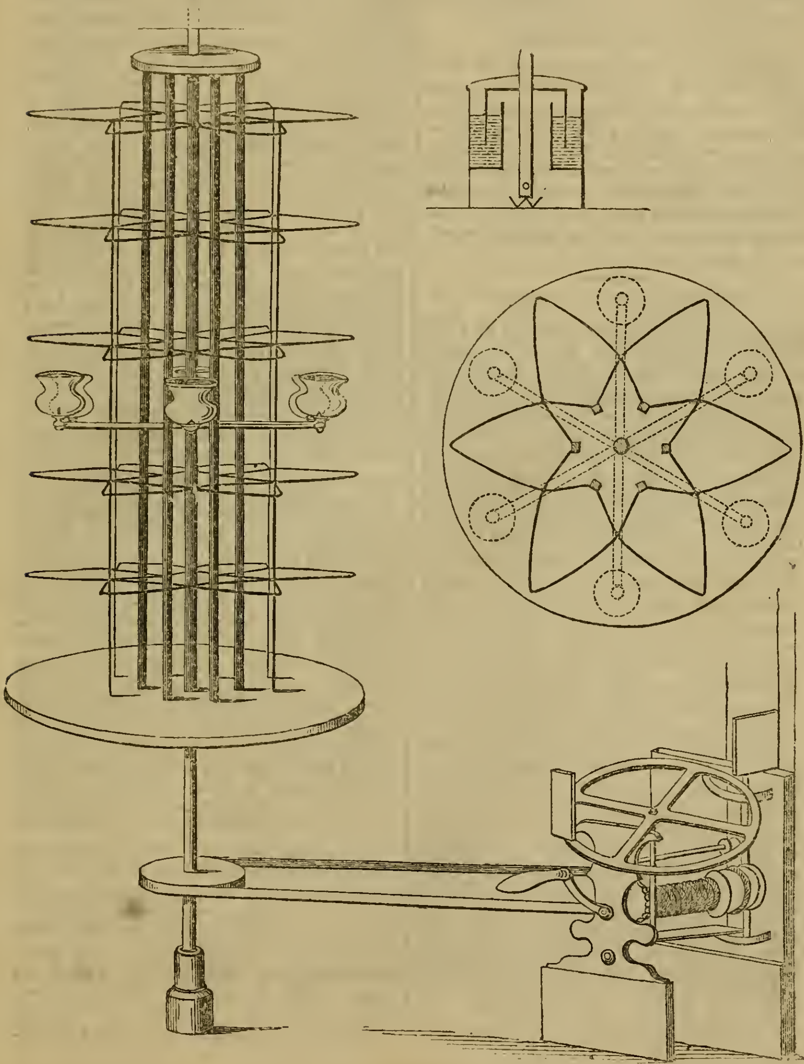

FIG. 3.

FIG. 2.

City Press, 1, Long Lane : Doudney and Scrymgour

THE WINDOW WHIRLIGIG.

Among the various methods to which tradesmen resort in order to call the attention of passengers to their shops, we meet with the following very singular mode (shown in our front page) at 97, Fleet Street, for the exhibition of fancy waistcoats. The revolving motion of from 200 to 300 patterns, together with the gas-lamps, produces a very novel effect, and attracts the attention of multitudes. The above, we are informed, was manufactured by Mr. W. Mornington, of No. 5, Frederick Place, Hampstead Road.

Description of Engravings.

Fig. 1 shows the elevation of the machine. Fig. 2, the apparatus by which fig. 1 is worked. The axle is acted upon by means of weights; the handle seen in the figure being used to wind it up afresh. Fig. 3, a transverse section, exhibiting the six globular gas lamps, working upon the centre, as seen in fig. 1, and supplied from the upright tube, running through a metre, as represented in fig. 4.

ON RADIANT HEAT.

The following abstract of a report by Prof. Powell (supplementary to one furnished to the Association in 1832), though not sufficient to form the basis of an unexceptionable theory, has, at least, tended greatly to modify previous opinions, and to enable us to refer large classes of phenomena to something like a simple and common principle. The former report was divided into various heads, according to the then existing state of our knowledge; but recent discoveries have so changed our views on the subject, that these divisions cannot, with any advantage, be adhered to. The researches to be described may be classed under two heads: first, as they relate to heat in its *ordinary* or *unpolarized* state; secondly, as they relate to *polarized heat.* The report then entered on the first general head, by calling attention to the recent researches of Melloni and Forbes respecting the *transmission* and *refraction* of heat. The professor adverted to the discovery of Melloni, that the resistance to the passage of heat is *not* exerted at the surface, but in tbe interior of the mass. This was a result of the observation, that the difference between the transmission of heat from a more highly-heated source, and from a less highly-seated source, became less as the thickness of the screen was diminished, and disappeared when very thin screens were interposed. By comparing the transmissive powers of a great number of substances, he found that in crystallized bodies the diathermaneity for the rays of a lamp was proportional to their refractive powers; but in uncrystallized bodies no such law could be traced. It was in the course of these researches that Melloni made the important discovery of the singular property possessed by rock salt—viz., that it is almost entirely permeable to heat, even from non-luminous sources. He found its transmissive powers six or eight times greater than that of an equal thickness of alum, which had nearly the same transparency and refractive power; and that, unlike other diathermanous media, it is *equally* diathermanous to every species of heat—i. e., whether from sources highly heated or moderately heated: thus he found a plate of seven millimetres (.28 inch) thick, to transmit ninety-two out of one hundred rays, whether from flame, red-hot iron, water at 212° or at 120° Fah. A plate one inch thick gave a similar constant ratio: the general conclusion being, that the source being a lamp, the diathermancy is not proportional to the transparency; and he makes some general remarks on these results, as related to those of Seebeck, on prismatic dispersion. In a supplementary paper, Melloni investigates the modifications which calorific transmission undergoes in consequence of the radiating source being changed. He employs four sources of heat—1. A Locatelli lamp; 2. Incandescent platina; 3. Copper heated by flame to about 730° Fah.; 4. Hot water in a blackened copper vessel. The discovery of the complete diathermancy of rock salt furnished the means of prosecuting the author's researches on the refraction of heat. In the successful experiment which he made, he concentrated in the focus of a rock salt lens, the rays of dark heat from hot copper and hot water. A similar lens of alum produced no effect, which proves that the effect is not due to the mere heating of the central part of the lens. In discussing the properties of the calorific rays immediately transmitted by different bodies, a remarkable effect presented itself: the rays of the lamp were thrown upon screens of different substances in such a manner that, either by changing the distances, or by concentration with a mirror or a lens of rock salt, the effect transmitted from all the sources was of a certain constant amount. This constant radiation was then intercepted by a plate of alum, and it was found that very different proportions of heat were transmitted by the alum in the different cases; from whence he (Melloni) concludes, "that the calorific rays issuing from the diaphanous screens are of dif-

ferent qualities, and possess (if we may use the term) the diathermancy peculiar to each of the substances through which they have passed." He next investigated the effects of *coloured glasses*, and concludes, that all the coloured glasses, except green, produce no "elective action" on heat: green glass, on the contrary, transmits rays more easily stopped than the others; and that green glass is the only kind which possesses a coloration for heat (if we may use the term), the others acting upon it only as, more or less, transparent glass of uniform tint does upon light. From experiments upon the solar rays transmitted by green glass, and intercepted by other media, he found they passed copiously through rock salt, but feebly through alum; whence he concludes, that there are among the solar rays some which resemble those of terrestrial heat, and, in general, that the differences observed between solar and terrestrial heat, as to their properties of transmission, are, therefore, to be attributed merely to the mixture in different proportions of these several species of rays.

Professor Forbes repeated and extended Melloni's experiments on the transmission and refraction of heat. One of the most interesting points to which he directed his attention, was the possibility of *detecting heat in the moon's beams*. These, concentrated by a polyzonal lens of thirty-two inches diameter, and acting on the thermo-multiplier, gave no indication of any effect; so that Professor Forbes considers it certain that, if there be any heat, it must be less than the $\frac{1}{300000}$th part of a degree Centigrade. In his third section he investigates the index of refraction for heat of different kinds, as compared with that for light in the same medium. The method of observation adopted was indirect, depending upon the determination of the critical angle of total internal reflection in a rock salt prism, with two angles of 40° and one of 100°. By an ingenious mechanical contrivance, the sentient surface of the pile was made to receive rays coming from the source of heat, after undergoing two refractions and one reflection, whatever was the angle of incidence. The results, which were but approximate, were as follows:—

Source of Heat.	Index of Refraction for Rock salt.
Locatelli lamp	1.521
Ditto transmitted through alum	1.548
Ditto .. glass	1.537
Ditto .. opaque glass	1.513
Locatelli lamp transmitted through opaque mica	1.533
Incandescent platina	1.522
Ditto transmitted by glass	1.538
Ditto .. opaque mica	1.534
Brass at 700°	1.518
Ditto transmitted by clear mica	1.527
Mercury at 450°	1.522
Mean luminous rays	1.552

The results deduced are:—

1. The mean quality, or that of the more abundant proportion of the heat from different sources, varies within narrow limits of refrangibility.
2. These limits are very narrow, where the direct heat of any source is employed.
3. All interposed media (including those impermeable to light), so far as tried, *raise* the index of refraction.
4. All the refrangibilities are inferior to that of the mean luminous rays.
5. The limits of dispersion are open to farther inquiry, but the dispersion in the case of sources of low temperature, appears to be smaller than that from luminous sources.

Prof. Powell dissents from the opinion of Ampère, that the difference between heat and light is to be accounted for by the difference of wave length on the undulatory hypothesis. During these researches, he found that a certain kind of green glass, coloured by oxide of copper, though it permitted a portion of luminous rays to pass, absorbed all the calorific rays; so that it exhibited no calorific action, capable of being rendered perceptible by the most delicate thermoscope, even when so concentrated by lenses, as to rival the direct rays of the sun in brilliancy. With respect to the transmission of heat by screens, Professor Forbes remarked, that Melloni's view of the transmission of heat of low temperature, by all substances alike, is equivalent to saying, that substances in general allow only the more refrangible rays to pass; or that while rock-salt presents the analogy of white glass, by transmitting all rays in equal proportions, every substance hitherto examined acted on the calorific rays as violet or blue glass does on light, absorbing the rays of least refrangibility, and transmitting the others only. To this rule, Melloni made out the first exception, or the first analogue to red glass—rock salt with its surface smoked. And Professor Forbes soon after pointed out another—viz., mica split by heat into numerous fine laminæ, and from thence, as the effect was obviously mechanical, since unlaminated mica pro-

duces no such effect, he concludes that the smoked surface of the rock salt acted also mechanically, and was thus led to try the effects of surfaces variously altered by mechanical means, and thus effects, in some distant degree analogous to *sifting* the heat, were observed. Fine powders also sifted on the surface, were found to affect the transmission of heat; and these Prof. Forbes considered analogous to diffraction and periodic colours in light. From these important researches, we have learned to connect modifications in the transmission of heat with the quality of refrangibility, and not, as heretofore, with a supposed difference of quality depending on the *source* of the heat.

In November, 1834, Prof. Forbes took up the subject and obtained complete success. He succeeded in polarizing heat from various sources, and by the aid of various substances, as piles of plates of mica, and by reflection and refraction, and showed that the peculiar modification of the experiments adopted by Berard, by reflection from glass, the quantity even at the maximum which could reach the thermoscope after two reflections, would be so extremely small, as that no difference of effect in the two rectangular positions could really have been perceptible. The report contained some remarks on the clearness with which the chronological order of the discoveries is marked in this case, and the consequent impossibility of any of those disputes which have sometimes tended to disturb the harmony of scientific inquiries. The Continental philosophers have the merit of devising and bringing to perfection the instrument, by the aid of which alone, any discoveries in this very delicate field of research could have been expected. Professor Forbes is the author of the discovery of the polarization of heat in all its branches, and from all its sources. The report concluded, by drawing attention to the difference which exists between Prof. Forbes and the Continental philosophers, as to the equal or unequal polarization of heat from different sources, and to the speculations respecting the cause of the variety of action of light and heat on our organs of sense, while both originate in undulations of the molecules of the same ethereal medium.

WIRE ROPE FOR SHIP'S RIGGING.

Those of our readers who are acquainted with nautical affairs, are, no doubt, aware, that during the last few years, iron has very generally superseded rope, in such parts of a ship's rigging as are permanent and not subject to friction. In steamers, the use of iron as a substitute for rope, has, of course, been carried to a greater extent than in sailing vessels; but it promises to be much more extensively employed than ever, in consequence of the adaptation of a wire to the purposes of the small descriptions of rope. The advantages to be obtained are, that the rigging of wire is smaller and lighter than that of rope, and, as it offers much less resistance to the wind, is of great advantage in beating to windward. The cost, too, is much less, and the durability greater. In several trials lately made at Liverpool, the following results were obtained:—

1 inch wire broke at	2 tons 1 cwt.		
$1\frac{1}{2}$	..	..	5 — 0
$2\frac{3}{8}$	..	..	8 — 14

Other sizes were also tried with proportional success; and, it should be remarked, that a three-inch hempen rope, of the best quality, broke at two tons one cwt. Another good quality of the wire, is its elasticity, which, though not, of course, equal to that of hemp rope, is quite sufficient to counteract the effects of a sudden jerk, while a vessel is rolling heavily at sea. One comparatively short length of wire rope that was tried, stretched $18\frac{1}{2}$ inches before it broke. A very short length of $1\frac{1}{2}$ inches diameter, stretched six inches. The machine on which the tests were made, is very ingenious, and of tremendous multiplying power: it is that on which iron cables for the largest ships are put to their utmost tension of many tons. On the whole, it was considered that the trial was very successful.

SCARBOROUGH AND YORK RAILWAY.

There can be no doubt that at some period, and not a very remote one, railway communications will be formed between all the important towns in England. Scarbro', the Brighton of the north, possesses every advantage that can be desired in a place of summer resort; and the projected line will confer an inestimable benefit on the inhabitants of the great inland manufacturing towns of Yorkshire. We learn from the *Leed's Intelligencer*, that "this great public undertaking, which has been several years before the public, will shortly be commenced, and carried forward with that energy and spirit which are necessary to insure its success. During the last week, Sir John Rennie (to whom a survey was entrusted in 1834,

by the corporation of Scarbro'), Mr. Fulton (the acting engineer), and Mr. Charles Fowler (the principal surveyor), attended a meeting of the promoters of the railway at Scarbro' and York; similar meetings are intended to be held at Leeds, a highly-respectable committee has been formed, solicitors and bankers have been appointed, a large portion of the proposed capital will be subscribed, and arrangements are nearly completed preparatory to applying for an Act of Parliament in the ensuing session. At York, the line will be connected with the west and south by the York and North Midland, the North Midland, the Leeds and Selby, the Derby and Birmingham, the Leeds and Manchester, and the Manchester and Liverpool, the Midland Counties, and the London and Birmingham Railways; with the east by the Hull and Selby; and with the north by the Great North of England Railway, which will be opened as far as Darlington next month. By a junction with the Whitby and Pickering Railway, it will connect itself with an extensive commercial, shipping, and agricultural district; and, by so doing, will, no doubt, materially increase its own prosperity, while it will enlarge the traffic at present conveyed on that line. The distance of the proposed railway from York to Scarbro' will be thirty-eight miles, being nearly three miles shorter than the turnpike-road. The public advantages which will arise from the formation of this railway are considerable. In 1824, it was calculated that 20,000 persons visited that fashionable summer resort, Scarbro'. Since the opening of the railways from the manufacturing districts to York, it has been estimated that 30,000 annually visit that town; and there can be no doubt, that were a railway formed from York to Scarbro', there would be a corresponding increase of visiters of upwards of 100,000.

The whole journey from London to Scarbro' will be performed in twelve hours; and, probably, at some future period, in a still shorter space of time."

REVIEWS.

The London and Birmingham Railway Pocket-book; containing accurate Information upon all subjects connected with Travelling on that Road, and Views of the most Remarkable Places on the Line and its Vicinity. By R. Brooks.

The descriptive part of this little volume was originally written for the "Mechanic and Chemist;" it is, therefore, needless to expatiate largely upon it, but we can assure our readers that it contains accurate information upon the different subjects on which it treats. We must leave it to them to decide how far the writer has succeeded in rendering it amusing by the introduction of a variety of anecdotes, &c. It contains copious tables of the distances, fares, &c., from every station to every other station on the line. It is also embellished with numerous engravings; and as it has been favourably noticed by some of our respected contemporaries, we are encouraged to recommend it to the favourable notice and patronage of the public.

Plain Rules for the Preservation of Health, Hearing, and Sight. By John Harrison Curtis, Esq.; abridged from his Works on the Ear, Eye, &c. Printed on Cards. London, 1840. Darton and Clark.

There is now a growing opinion among those best informed on the subject of education, that the elements of the science of health should form a part of school instruction; not only as being a most interesting and instructive branch of knowledge, but also as being of great practical utility: for when we consider that the constitution of the young is as yet unfixed, and, therefore, peculiarly susceptible to morbific influences, the consequences of which may, perhaps, be permanent; it will at once be admitted, that ignorance of the principal laws of health on the part of the young, is likely to expose them to many evils which might be avoided, were they aware of the tendency of not a few of their practices. On this account we rejoice in the appearance of these cards, which present the fundamental truths of the science of health in a more condensed and intelligible form, than we remember to have ever before seen; and in a shape, and at a price, which render them peculiarly adapted for the use of the young, both at school and elsewhere, who should be taught to con them over and commit them to memory, in the same way as they are in the habit of doing with lists of weights and measures, or any other branch of study. The boy, for instance, who is full of spirit and activity, would thus be put upon his guard against over-exertion, to which his temperament is too apt to lead him, and which ruins the constitution of many a promising youth. The child, on the other hand, whose only pleasure is in books and study, may here learn, that those moderate and cheerful exercises, in which his equals in years indulge, and

which to him appear to be so much time wasted, are really as useful and necessary as those more quiet pursuits in which he delights; and that, by neglecting them, he is diminishing his capabilities for mental exertion. Teachers, also, may derive many valuable hints from these brief compendiums, and may hence learn the proper limits to be imposed upon their young charges, both as to study and exercise.

The Cards on Hearing and Sight show that many of the diseases of those important senses result from the thoughtlessness of the young, whose momentary imprudences, occasioned too often by ignorance, frequently lay the foundation of maladies never wholly eradicated. Sitting on damp grass when in a state of profuse perspiration, for instance, is an every-day occurrence among boys; yet this is stated in the Card on Hearing, to be a common cause of deafness. Rubbing the eyes when any foreign body gets into them, is so natural an action, that we need to be strongly impressed with its impropriety, before we can break ourselves of the habit; and, accordingly, it is all but universal among the young. In the Card on Sight, they are expressly warned of the danger of so doing; and an easy remedy for the inconvenience which occasions it, is explained.

We have given these instances at random, to show how useful such publications as these would be, if put into the hands of the young; but we might select many others equally forcible; and we seriously recommend the adoption of them into schools and families. We should mention that, although we have confined our remarks to the utility of these cards to the *young*, they themselves are not so limited in their scope, but contain advice relative to every period of life.

LIST OF NEW PATENTS.

[We shall, in future, give a list of new patents in each Monthly Part of the "Mechanic;" they will be chronologically arranged, according to the date of sealing, and will, we trust, be found valuable to a vast number of our readers, both as supplying early information, and for reference at future times.]

Frederick Payne Mackelcan, of Birmingham, for certain improved thrashing machinery, a portion of which may be used as a means of transmitting power to other machinery. Sealed October 1, 1840. (Six months.)

Thomas Joyce, of Manchester, ironmonger, for a certain article which forms, or may be used as a handsome knob for parlour and other doors, bell-pulls, and curtain pins; and is also capable of being used for a variety of useful and ornamental purposes in the interior of dwelling-houses and other places. Sealed October 1, 1840. (Six months.)

William Henry Fox Talbot, of Lacock Abbey, Esq., for improvements in producing or obtaining motive power. Sealed October 1, 1840. (Six months.)

William Horsfall, of Manchester, card-maker, for an improvement or improvements in cards for carding cotton, wool, silk, flax, and other fibrous substances. October 1, 1840. (Six months.)

James Stirling, of Dundee, engineer, and Robert Stirling, of Galsten, Ayrshire, Doctor of Divinity, for certain improvements in air-engines. October 1, 1840. (Six months.)

George Ritchie, of Gracechurch Street, and Edward Bowra, of the same place, manufacturers, for improvements in the manufacture of boas, muffs, cuffs, flounces, and tippets. October 1, 1840. (Six months.)

James Fitt, senior, of Wilmer Gardens, Hoxton Old Town, manufacturer, for a novel construction of machinery for communicating mechanical power. October 7, 1840. (Six months.)

John Davies, of Manchester, civil engineer, for certain improvements in machinery or apparatus for weaving. Communicated by a foreigner residing abroad. Sealed October 7, 1840. (Six months.)

Thomas Spencer, of Liverpool, carver and gilder, and John Wilson, of the same place, lecturer on chemistry, for certain improvements in the process of engraving on metals by means of voltaic electricity. Oct. 7, 1840. (Six months.)

Thomas Wood, the younger, of Wandsworth Road, Clapham, gentleman, for improvements in paving streets, roads, bridges, squares, paths, and such like ways. Sealed October 7, 1840. (Six months.)

Charles Payne, of South Lambeth, gentleman, for improvements in salting animal matters. Sealed October 13, 1840. (Six months.)

Robert Pettit, of Woodhouse Place, Stepney Green, gentleman, for improvements in railroads, and in the carriages and wheels employed thereon. Sealed October 15, 1840. (Six months.)

Henry George Francis, Earl of Ducie, Woodchester Park, Gloucester, Richard Clyburn, of Uley, engineer, and Edwin Budding, of Dursley, engineer, for certain improvements in machinery for cutting vegetable and other substances. Sealed October 15, 1840. (Six months.)

William Newton, of Chancery Lane, civil engineer, for certain improvements in engines, to be worked by air or other gases. Sealed October 15, 1840. (Six months.)

Henry Pinkus, of Panton Square, Middlesex, Esq., for an improved method of combining and applying materials applicable to the formation or construction of roads or ways. Sealed October 15, 1840. (Six months.)

Charles Parker, of Darlington, Durham, flax-spinner, for improvements in looms for weaving

linen and other fabrics, to be worked by hand, steam, water, or any other motive power. Sealed October 22, 1840. (Six months.)

Richard Edmunds, of Bunbury, Oxford, gentleman, for certain improvements in machines or apparatus for preparing and drilling land, and for depositing seeds or manure therein. Sealed October 22, 1840. (Six months.)

Thomas Clark, of Wolverhampton, iron-founder, for certain improvements in the construction of locks, latches, and such like fastenings, applicable for securing doors, gates, window shutters, and such like purposes. Communicated by a foreigner residing abroad. Sealed October 22, 1840. (Six months.)

Gabriel Riddle, of Paternoster Row, stationer, and Thomas Piper, of Bishopsgate Street, builder, for a certain improvement or improvements on wheels for carriages, for the term of seven years, being an extension of former letters patent granted to Theodore Jones, of Coleman Street, and by him assigned to the said Gabriel Riddle and Thomas Piper. Sealed October 22, 1840.

MISCELLANEA.

Discovery of a New Light, and Caution to Experimentalists.—The master of the *Breakwater* light-vessel, in the Sound, has discovered a new mode of preparing the common oil now used for lights on board light-vessels, so as to give a light never yet equalled; and should it be adopted by engineers of steam-ships, &c., the advantage to them will be very great. The matter would have remained over till the meeting of the British Association next year, when, most likely, a paper on the subject would have been read, but for an accident; and hence the caution. The master had prepared a bottle of the said on board, with a view to experiments on shore (it would have endangered the ship to have lighted it on board); but the men and boys knew nothing of the secret, and seeing the bottle, thought the contents to be for common use, and brought it to light: whereby they have sadly injured themselves, and declare they cannot see clearly since; and they are now on board the *San Josef* for treatment. The experimental oil, &c., has been submitted to the judgment of some officers, civilians, and others. and the effect has been partially to deprive them of the power of seeing clearly for some time. We should trust that the brave captain of the *San Josef*, whose prerogative it is to know what is done on board light-vessels, and who is himself an eminent public experimentalist, for the good of the Navy, will not suffer the matter to lie " bottled up" for private advantage, but that he will cause it to tend to the good of the service generally, which we believe is an object near his heart, and that he will see justice done to the poor sufferers. We have given the foregoing on the authority of the *West of England Conservative*. There appears to be some exaggeration in this account; but no well-founded opinion can be formed, till the whole process is explained, and its results exhibited.

Electrotype.—The method discovered by M. Jacobi, of procuring, by means of electricity, convex impressions, or impressions in relief, similar to the outline of a given model, continues to be applied in France with success This process, to which M. Jacobi has given the name of " plastic galvanism," consists in decomposing, by means of an electric current, a solution of sulphate of copper, in which the mould that receives the impression is placed. The moulds may be of metal, of wax, of wood, of plaster, or even of stearine.* When M. Jacobi makes use of a mould that is not metallic, he covers the surface of it with graphite or plumbago. This process has already been turned to considerable advantage in Russia, in those manufactories where articles of luxury or of domestic use are manufactured. It has also been employed by the inventer to reproduce the photogenic image formed in the Daguerreotype. M. Jacobi makes use of one of the metallic plates on which an image has been obtained by the process of M. Dagnerre, as a mould in the apparatus where the galvanic reduction of copper is effected. After twenty-four hours' exposure to an electrical current, he has obtained a galvanic tableau, with a distinct impression of the photogenic image. Methods similar to these have been employed by M. Bocquillon, in Paris, to produce very extraordinary metallic moulds from the printed impressions of vignettes, &c.; and the attempts at copper-plate engravings by means of this process, which M. Richoux has just presented to the French Academy, show a degree of neatness and finish that is inferior to nothing of the kind which has been undertaken.—*Inventer's Advocate.*

Experiments on Iron.—The extensive and rapidly-increasing applications of iron to public and private structures of all kinds, in which durability of material is a first requisite, make it highly desirable to possess accurate information respecting the nature of the chemical forces which effect the destruction of this hard and apparently intractable metal. The preservation of iron from oxidation and corrosion, is, indeed, an object of paramount importance in civil engineering. Mr. Mallet, a gentleman peculiarly qualified for such investigations, both from his knowledge as a chemist, and from his opportunities of observation as a practical engineer, is engaged in making an extensive series of experiments in order to determine, first, the action of sea and river water—in different circumstances as to purity and temperature—upon a large number of specimens of both cast and wrought iron of different kinds; secondly, the general conditions of the oxidation of iron, and how this operation is greatly promoted, although modified in its results by sea-water; thirdly, in what manner the tendency to corrosion is affected by the composition, the grain, porosity, and other mechanical properties of the different commercial varieties of iron; fourthly, the influence of minute quantities of other metals, in imparting durability to iron; and, fifthly, the consequences of the galvanic association of different metals with iron—a subject of great interest, from the applications of zinc and other metals to protect iron. These

* The solid part of fat or oil, seperated from the elain, or fluid part.

experiments are still in progress, and will, when completed, afford valuable data for the engineer and chemist. P. TRUMAN.

The variation of the sun's influence in the earth, does not extend beyond a certain depth, and augments in some places more than in others. At a colliery at Wigan, the surface temperature was about 50°; fifty yards deep, the temperature was constant, 53°; at 150 yards, temperature constant, $56\frac{3}{4}$°; and about 1° for sixteen yards, while in France it was 1° in fifteen yards. At twenty-six feet, it may be twelve months before the sun's heat reaches that depth.—*Phillips.*

G. DAVIDSON.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, December 2, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, December 3, the New Lecture Room will be opened. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 30, Mr. F. Snell, on Sacred Music. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 2, Mr. R. S. Jeffs, on the Compounds of Hydrogen. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, December 1, Mr. F. Wilby, on Vital Education.

Bermondsey and Rotherhithe Literary and Scientific Institution, $4\frac{1}{2}$, Church Street, Rotherhithe.—Monday, Nov. 30, Discussion. At half-past eight precisely. A

Mr. Hadley's Rooms, No. 30, Orchard Street, Portman Square.—Thursday, December 3, Rev. S. Blair (Author of "Conversations on Mind and Matter"), on Memory.

QUERIES.

The process of manufacturing elastic or India-rubber tube? E. WHITEHALL.

By what process can paint be got off stone without injury to it? J. P. T.

The best method of bronzing medals? A. C. R.

The process of making window glass? T. B.

A good way to stain beech of a mahogany colour? I have seen some dark and some light, so that the difference, without a close inspection, was scarcely discernible. Also how the black picture-frames are done, which resemble polished ebony? I also wish to know how the patent leather is prepared for boot-tops; it appears a kind of varnish, mixed with pigment, suitable as to substance and colour, by which new leather is prepared, and old tops are renovated equal to new? W. C.

How saw-dust can be charred or burnt, in such a way as to be equally as serviceable as powdered charcoal? B. E.

[Burn it in a vessel through which there is no current of air allowed to pass.—ED.]

ANSWERS TO QUERIES.

To Varnish Casts of Plaster of Paris.—Equal parts of curd soap and white wax, about half-an-ounce of each to a quart of water; boil together about three minutes. It should be applied, when cold, by a soft brush. It soon dries, and may be polished by using a soft long-haired hat-brush.

WM. MAJOR.

In answer to "I. E. I." by experience I know, that plaster-of-Paris moulds can be cast from with lead or pewter, by the moulds being perfectly dry; no other preparation is required. J. P. T.

TO CORRESPONDENTS.

Mr. Sproule's *steam-boiler will appear in our next.*

J. J. P.—*The process of silvering glass for mirrors, has already been fully described in the "Mechanic."*

Alpha (and some others) *wish to know, the best material used for tooth-powder. We believe there is nothing better than finely-powdered charcoal.*

X. *We cannot recommend a better plan for the formation of a scientific institution, than that adopted by the Bermondsey and Rotherhithe Institution—1st. The formation of a library of reference and circulation. 2ndly. Lectures on the various branches of science, literature, and mechanics. 3rdly. The reading of original or other essays by the members on any subject most congenial to their pursuits (except on religion or party politics). 4thly. All essays read before the Institution, are open to a free discussion, much benefit accruing to the members by an interchange of thought and sentiment.*

C. Davidson.—*We shall be glad to see the paper he mentions. We thank him for the communications we have received, and shall avail ourselves of them.*

A. C. P.—*The Bude light is produced by passing a stream of oxygen through a common argand burner.*

Hope.—*His question was answered some time ago; the 5 at the 11th place of decimals (page 296, Vol. IV.), must be expunged. It is a mistake of the printer's. Vince's "Elements of Astronomy" is as good a book as any upon that subject; but it is necessary to be conversant with the algebraical mode of calculation, in order to understand the reasoning by which the demonstrations are established. This applies to all works that enter deeply into the subject.*

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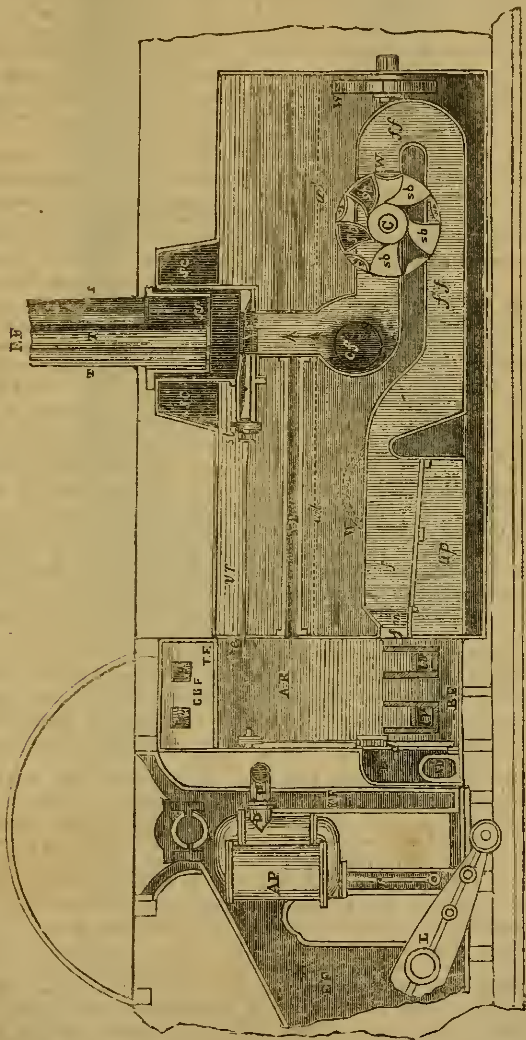
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 122, NEW SERIES. | SATURDAY, DEC. 5, 1840. PRICE ONE PENNY. | No. 243, OLD SERIES.



SPROULE'S STEAM-BOILER.

FIG 1.

City Press, 1, Long Lane: Doudney and Scrymgeour.

SPROULE'S STEAM-BOILER.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—I beg leave to lay before you a plan of a steam-boiler; the object of which is, to prevent explosion of boiler—so far as bare flues are concerned—to consume its own smoke, and to dispense with the funnel of the boiler when at sea.

The first of the three objects has hitherto been contemplated and desired with almost the same success in every level of society. Plans from all classes and characters have in close succession been before the public, and have as rapidly vanished before the breath of the judicious in mechanics. My plan, among the rest, has struggled long for life, and has been a thing about which the scientific seem at last to respect as nothing. Whether this should be its deservings, you will gather from itself; premising, first, a few remarks connected with causes of explosion.

The causes of steam-boiler explosion may be considered two in number—namely, excessive pressure of steam, resulting from overloading the safety-valve; and stoppages, or want of a proper supply of water, whereby the flues of the boiler are weakened by the action of the furnaces, and the steam excessively heated. Hall's condensers, as a remedy for the latter evil, would be complete, if pumps could be wrought without valves, and the vessel be made to obey the same trim in all circumstances; but where there is the smallest chance of the water being delayed to the boiler, or the flues being uncovered, I say, it is the faith of the prudent ever to be on the alert.

The end, therefore, I have ever had in view, since I began to interest myself in this important matter, has been to plan something that would, at all times, and under all circumstances, operate to the safety of the boiler, independent of the care or attention of any individual; and I think this can be accomplished by a very simple apparatus applicable to most steam-boilers, of both high and low pressure.

The construction I have given in fig. 1, at w and w of this instrument, is variable, of course; but the end to which it acts, is the certain prevention of the steam ever acquiring an atom of heat among its particles, more than should be in thermometrical quantity with its density.

w and w of fig. 1, is a wheel made as large as possible for the boiler, which revolves by the one side of it being always buoyed round and round by the steam, which enters into the steam-buckets, *s b*, *s b*, *s b*, &c., on one side only; while the same steam-buckets on the other side of the wheel are filled with water, in which the wheel is seen at present to be totally immersed, *w b*, *w b*, being the proper level of the water in the boiler.

As the wheel revolves, it carries round on its circumference a number of smaller buckets, *w b*, *w b*, *w b*, which, owing to their make, in respect to the larger buckets, or the way the wheel revolves, are continually filled with water. In the bottom of the smaller buckets, *w b*, *w b*, &c., there are holes, through which the water they lift would flow in streams, if the top of the wheel was not below the level of the water in the boiler.

Now suppose the water in the boiler is getting low, or before the boat has yet left her moorings, let the water be too low in the boiler, the steam generating, and the wheel, w, will be revolving in the boiler, as I have explained; but the top of the wheel, w, will now be above the water, and, consequently, the water is carried up in the buckets, *w b*, *w b*, *w b*, above the water in the boiler, or above the bare flues; therefore the water will fall from the height to which it is lifted, through the holes in the bottom of buckets, down through the steam, absorbing every excessive atom of heat that may pass into the steam from the bare flues of the boiler; for it is evident, that if the water of the boiler is lifted above its unabsorbing level into the steam, incessantly heating above its proper degree of thermometrical heat, and so above the temperature of the water below the flues, that it will ever maintain an equilibrium of heat and just temperature in the steam, by its absorbing from the steam the heat above the temperature of itself, which, of course, will go to the generating of new steam; the same as if the heat had passed from the flues of the boiler direct into the falling drops of water.

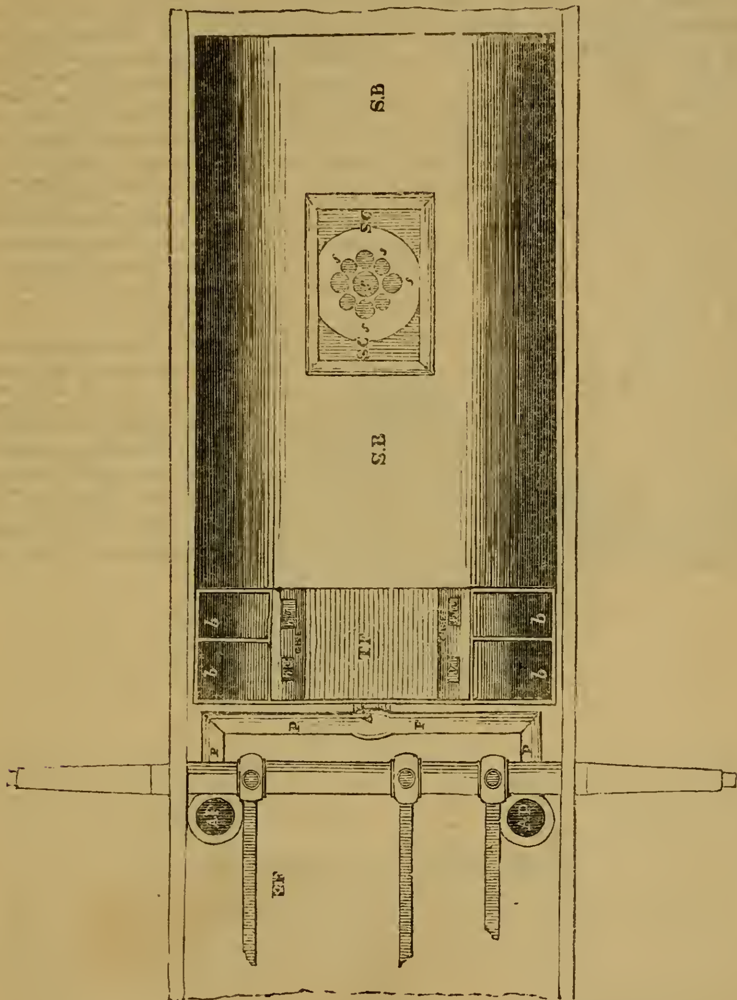
It is evident that the flues of the boiler (granting they are free of crust) will never arrive to a heat that would in the smallest degree weaken them; for it is only when the steam gets dry and hot, that the flues of the boiler become dangerously red, there being not sufficient moisture in the steam to weaken the action of the furnaces on the flues; therefore a collapse of flue is rendered impossible, while an insurmountable barrier is ever opposed to decomposition, or anything of that sort.

This wheel could be greatly increased in power or useful effect, by having a pair in the boiler, with a soft spongy band pass-

ing over the two; as this band would absorb much water, which would be delivered to the action of the heat along the stretch between the two wheels.

As much water lifted per minute as the quantity of feed per minute, is sufficient, if properly distributed among the steam, to insure the greatest amount of safety

Fig. 2.



from this quarter of danger in steam-boilers. As for safety-valves, the common valve is the best, if not abused; and no improvement can be made on it, except by closing it in from the reach of the ignorant.

The funnel of the steam-boiler of a sea-going vessel can, I think, be easily dispensed with at sea, by an arrangement of boiler and machinery shown in figs. 1, 2, 3, and 4, which I will state the argument of, before entering on the description.

Air which is drawn through the fuel of the furnaces, by the draught of the funnel

to occasion combustion, is, in this boiler, forced through the furnace to promote combustion, which consumes the smoke and dispenses with the funnel at the same time, by the air being compressed till it be in proper ratio with the hydrogen or smoke of the fuel or denser, that the whole, after passing through the furnaces and flues of the boiler, may force out into the sea beneath its surface.

In figs. 1 and 2, A P is a double-acting air-pump, which is seen placed well out of the way on the outside framing of the engines. These pumps receive motion from the side-beams of the engines by the piston-rod, *r*, being connected in the usual way; L represents the side-beam.

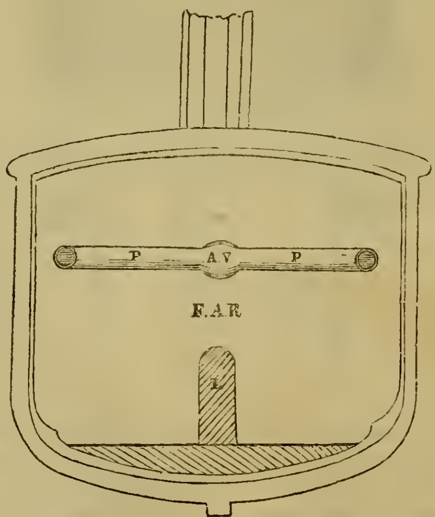
Across the front of the boiler enclosing the coal-boxes, C B, C B, in fig. 4, is a face of iron, forming between the boiler and itself and the two coal-boxes, a receiver for the air forced into it by the pumps, A P. F A R, in fig. 3, represents the outside of this air-receiver; fig. 4 shows the outside removed, representing the interior of the coal-boxes, C B, C B, and the front of the steam-boiler.

In fig. 2, P P, P P, are the pipes conveying the air from the pumps, A P, to the receiver, the top of which is the floor, T F. The air-pipes, P P, in fig. 3, show where the air enters the front of the receiver at the vent, A V, which is the same A V of fig. 2. In figs. 1 and 2, C B F is the coal-box top, into which the coals are thrown by the coal-trimmers standing on the top of the air-receiver; T F, T F, in figs. 2 and 3, show the same floor.

When the coals are being taken out of the partition, *c* or *b*, in fig. 2, by the stokers below in the air-receiver, at either of the ports, *l v*, *l v*, *h v* or *v* is shut on the top ports of the same partition of the coal-boxes; *v* of *h v* is a valve seen half removed from the port, while *v*, the same kind of valve, is covering the port of the other partition. The coals would be removing, in the meantime, from the partition that has the top port shut, while the other partition would be refilling with coals. Similar valves are fitted to the bottom ports of the partitions, which are not shown; they must close on the port from the outside, while the top valves close on the port from the inside.

It is easy to perceive, that the object of this valve-geer is to prevent the air escaping from the receiver through the coal-boxes. This object, and all concerned about the boilers, could be easily accomplished, by enclosing the fuel in one grand receiver, and firing the boiler from the end farthest from the engines; and it would be the best way if the vessel was built of iron, or the ship to be lined with boiler-plates, to form the coal and air re-

FIG. 3.



ceiver; for it must be perfectly air-tight, and built in the manner of a boiler.

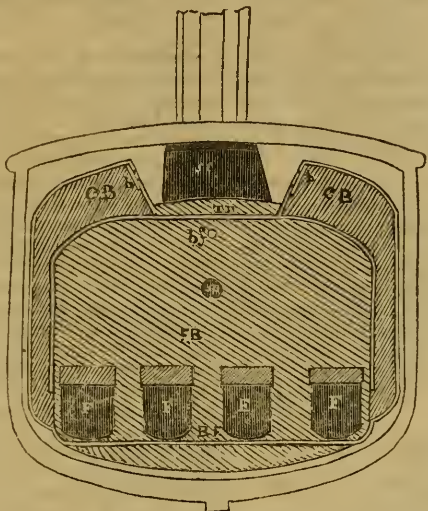
In figs. 3 and 1, L is the entrance by which the stokers go in and out of the receiver. It is constructed on the same principle as a canal lock, and holds one or

two men; L D is the door from the ship into the lock, and *d* is another door rising upwards, and opening the lock to the air-receiver. The use of the lock is to get rid of the ashes of the furnaces, as well as for the entrance to the boilers.

In fig. 1, *f m* is the furnace mouth; *f*, the furnace; *a p*, the ash-pit; *f f*, *f f*, are the flues of the boiler, joining at *c f*, in the usual manner, up in the direction of the arrows from the joining of the flues; the flues terminate at the top of the steam-chest, S C, S C; S C, of figs. 2 and 3, is the same chest; and S B, S B, in fig. 2, is the top of the boiler.

Suppose now, that the ship is preparing for sea, before the furnaces are kindled, there is placed on the top of the flues where the funnel stands, a portable funnel, P T, composed of the single pipes or iron tubes, T T, &c., each being as light as one or two men may put up with ease by hand; *s s*, *s s*, &c., in fig. 2, show the steps of each of these tubes of fig. 1. A little below the steps of the tubes in fig. 1, is a valve, which is shown drawn back from its seat, *v s*; *v r* is the valve rod, passing through the stuffing-box, *s b*, in the boiler; through the end of the boiler the rod is seen to pass to the hand of the engineer;

FIG. 4.



the rod is for opening and shutting the passage of the flues from their forced course, S P, or their natural course, up the funnel, P F, by moving the valve, *v*, in and out of its seat, *v s*.

When the furnaces are kindling, the vent valve, *v*, is drawn to where it is now seen; and a sufficient draught by the portable flunnel will, in the meantime, get up the steam. Let the engines be set in motion, and the ship be got clear of the crowded river, &c.; the air-pumps are thrown in geer with the engines, and the air is discharged into the receiver.

Let the doors of the coal-boxes, *v v*, &c., and the doors of the lock, or one, at least, be closed; the air that the pumps are throwing into the receiver will pass through the furnaces up the portable funnel; but let the valve, *v*, below the steps of the tubes, be slowly pushed into its seat, V S, then will the air in the receiver be slowly becoming denser, until it balance the weight of water outside the ship, where it is now discharged. The contents of the furnace being stopped by the valve, *v*, from passing up the funnel, P F, the tubes, T T T, &c., that compose it, are now unshipped from the boiler, and placed out of the way, leaving a clear deck and unclouded atmosphere.

S P is the passage from the flues to the outside of the boiler, where it may be afterwards taken through the ship, as it is seen convenient; though, if the ship is not over deep for the purpose, through the bottom of the ship the smoke-pipe should pass.

At all times the pressure of the air in the receiver, and, consequently, in the flues of the boiler, should be more than the weight of the water that has to be

overcome for the discharge of the contents of the furnaces; and this can be done by placing a valve on the discharge pipe, s r, so as to open to the current from the furnaces towards the vent end, having it properly loaded, to give the density in receiver desired. The vent passage, it will be seen, will not require to be the same size as the funnel, by a great deal; a small passage, of about a twentieth in area of the funnel usually employed, will be quite sufficient to carry off the fumes of the furnaces, &c.

That the smoke of the furnaces will be consumed to the atom, I think is self-evident, nor will be doubted by any one acquainted with the subject. Likewise, I think, no annoyance will be felt from the fumes rising from the water up around the ship, as, when it emits from the surface of the sea, it will instantly unite with the oxygen of the atmosphere and form the heaviest of our gases; consequently, it will remain on the dead surface of the sea, &c.

Sir, perhaps it may not be uninteresting to you to know, that these plans, but especially the first, have gone the round of a thousand mechanical and scientific men for four years past, without meeting with a single argument against them. Trusting, now, however, for a judicious sifting of their worth, if you bestow them a place in your Magazine, I beg leave to remain,

Sir, yours most respectfully,

M. Sproule.
Engineer.

IRONBRIDGE MECHANICS' INSTITUTE.

On Wednesday evening, November 25th, the Provisional Committee called a general meeting of those persons who had enrolled their names as members of the Institution, which was held in the Infant School-room, Ironbridge; the meeting was large and well attended. Alfred Darby, Esq., of Coalbrook Dale, having taken the chair, the rules for the government of the Institution were read and passed; they then proceeded to elect a Board of Directors, consisting of President, four Vice Presidents, and thirty Committee-men (fifteen of whom are operatives), into whose hands the sole management of the Institution is vested. A vote of thanks was next returned to the Provisional Committee, and to their acting secretary, Mr. Walker. The chair being vacated, a vote of thanks was returned to the worthy chairman for the able and efficient manner in which he had conducted the meeting. The chairman returned his thanks, and expressed his gratification at seeing so large an assembly, assuring the meeting that they should always have a continuation of his support in any way that would be serviceable to the Institution. Abraham Darby, Esq., next rose, and having entered fully into his brother's sentiments in the most noble and generous manner, encouraged the members to proceed; for he felt fully persuaded, that not only the working man, but the rich, would be benefitted by a union of the talent which would be brought into requisition by this Institute. After a few more short speeches by Messrs. Edwards, Bayliss, &c., the meeting concluded with marks of the warmest approbation.

I stated in my last note, the favourable circumstances with which we were surrounded; indeed, I think the starting of this Institute is without a precedent. Before its commencement, about 300 persons have enrolled their names. Gentlemen are stepping forward in every direction who offer their help and assistance, and working men generally are ready to embrace the advantages offered to them. It is a pleasing scene to see the good-will and fellowship that reign between master and man; all distance is banished; employers and employed are both endeavouring to facilitate business, and to establish the Institute on a firm and sure footing. An example is here offered, which, I trust, will be followed in every place where a Mechanics' Institute is not formed; and may working men in parts of the kingdom find as good friends and supporters in their employers, as they do in the neighbourhood of Ironbridge and Coalbrook Dale.

J. C.

Coalbrook Dale, Shropshire.

Meteors.—On the 26th of August, 1839, a splendid meteor was seen towards the shores of Albania, near Kontzolara. It is said to have left behind it a broad fiery tract for twenty seconds. On the 9th of November, 1839, at Antigua, a little after day-break, a concussion was felt in the town, preceded by a sound like the heavy discharge of ordnance. On inquiry, it was found that a brilliant meteor had been seen by some servants and labourers. On the 13th of May, 1840, a meteor larger than the full moon, was seen at Albany, Boston, Newhaven, Rhode Island; there was a brilliant train left behind, which retained its brightness some seconds after the main body had become entirely extinct. It exploded with great force.—*Silliman's Journal.*

THE BRITISH NAVY.

Considering our present position as it respects the probability of war, it may not be uninteresting to our readers to know what was the result of the efforts made by our gallant seamen during the unprecedented war, which ended in the year 1815.

General Statement of Ships Captured from Hostile Powers and Destroyed in Action during the War, from 1793 *to* 1801, *and* 1803 *to* 1815.

	Ships of the Line, including Fifty-fours.		Fifties.		Frigates.		Sloops and Small Vessels.		Total.	
	Ships.	Guns.	Sh.	Guns.	Ships.	Guns.	Ships.	Guns.	Ships.	Guns.
French	80	6264	7	354	217	7382	408	3997	712	17,997
Dutch	29	1794	—	—	40	1336	103	775	172	3,905
Spanish	24	1984	—	—	30	1068	142	941	196	3,993
Danish	24	1774	—	—	24	848	37	475	85	3,067
Russian	1	74	—	—	2	74	1	14	4	162
Turkish	1	64	—	—	7	270	7	96	15	430
American	—	—	—	—	3	139	14	176	17	315
Total	159	11,954	7	354	323	11,117	712	6474	1201	29,869
British	5	370	2	100	27	856	132	1891	166	3,017
Difference	154	11,554	5	254	296	10,261	580	4783	1035	26,852
Enemies' Ships lost by accident	11	—	—	—	14	—	Many	—	—	—
British ditto ..	32	—	7	—	86	—	230	—	355	—

Officers who lost their Lives during War while in Command of Vessels, to 1809.

	Killed.	Blown up.	Drowned.
Post Captains	22	4	26
Commanders..............	10	1	35
Lieutenant Commanders ..	16	0	23
Vice Admiral	1 (Nelson)	0	0
Rear Admiral	0	0	1 (Troubridge)

British Navy, July, 1815.

	Ships of Line.	Frigates	Sloops, &c.	Brig and Small Vessels.
At sea	34	86	76	131
In Port and Fitting	31	61	51	52
Guard Ships................	4	4	4	10
Hospital and Prison Ships	2	0	1	0
In Commission	71	151	132	193
Ordinary and Repairing	118	77	37	36
Building	17	9	4	1
Grand Total......	206	237	173	230

But we would caution our readers against too confidently calculating, that such must of necessity be the invariable success of our navy. Many reasons might be given for such a caution; and without wishing to put forth our religious opinions, we cannot avoid observing, that these things are in the hands of the Great Disposer of all events; and that he does not always award the victory to the strong, we, as a nation, have good reason to know. But, to return to the visible means of success, in which it behoves us to be prudent, we cannot but think that, as a maritime nation, we have not been sufficiently attentive to this right arm of our strength.

We have, by various means that we could name—had we space, and were such discussions adapted to this work—degraded the character of our seamen, so that the defenders of our country hold not the same position which they once did, and which they have well merited. The result has been, that few parents will send their children to sea who can avoid it, therefore we want those prime seamen who respected themselves and were respected; and who, at the commencement of the war already alluded to, produced, by their success—at first well disputed by the enemy—that moral effect which contributed to the brilliant success that attended our navy. This may be denied by some, but we defy them to prove that it is not correct.

Much as we are gratified by our success at St. Jean D'Acre, we do not think it at all militates against the opinions we have advanced. We are perfectly aware that great attention has been paid to the art of gunnery, but this does not prove that seamen have not been neglected; and it must be admitted, that this action has not been of a nature to show what would have been the result of a contest between two hostile fleets.

We have, perhaps, for a mechanical work, travelled a little out of our way in this article, but we would ask our readers whether a ship is not one of the most noble pieces of mechanism? The vast quantity of material, and the great expense of labour in constructing one of our first rates, we gave an account of in No. 108, N. S. From the contemplation of such a structure, we are necessarily led to the consideration of the great advantage that has resulted to this nation from them, and then to the hearts of oak that manned them, and the neglect with which this class of our fellow-countrymen have been treated; and, we trust, that our readers will excuse our having occupied some of our pages in this way, in consideration of the importance of the subject. We may, perhaps, return to this subject, and treat it more mechanically.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, December 10, Cowden Clarke, Esq., on Milton. At half-past eight.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 9, Mr. Gaze on Hydrostatics and Hydraulics. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, December 8, Mr. Thomas, on Sulphur.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 10, Mr. Walter Hume, on the Life, Genius, and Writings of Cowper. At half-past eight precisely.

Mr. Hadley's Rooms, No. 30, Orchard Street, Portman Square.—Thursday, December 10, Rev. S. Blair (Author of "Conversations on Mind and Matter"), on Memory.

QUERIES.

Diameter of cylinder, length of stroke, and thickness of metal (brass) for cylinder of engine of one-horse power, high pressure? Also, length, breadth, height, and thickness of metal (iron) for boiler for ditto? A. B.

The best method of making the best lamp-black? Also how to make the best vegetable-black? Also the simplest method of making a lithographic press? A.

To make artificial human eyes? To paint mahogany colour in oil? To imitate zebra wood in paint? To stain wood black? To stain violins a dark colour? To prevent lead from oxidizing? C. S.

The best process of colouring wax candles in red, pink, blue, green, and yellow?
A. M.

I have tried in vain to inflame gunpowder with my electrical battery, which consists of nine two-pint jars. I have enclosed the powder in cases, made of paper and wood; I have even confined it in glass tubes; but the charge appears to pass through it as freely as through a good conductor. If any of your enlightened correspondents can inform me of another method, or the probable cause of my failure, they will greatly oblige
A. Y. E.

TO CORRESPONDENTS.

J. Child.—*Marble is polished with an oxide of tin, called putty-powder.*

G. Mitchell.—*The arteries are divided into ramifications, which extend to the brain and all parts of the body. The brain receives about one-tenth part of the whole mass of blood. (See "Mechanic," No. 76, N. S.) "Hooper's Anatomist's Vade Mecum" is the best work we can recommend him to read.*

J. B.—*The atmospheric engine, exhibited last summer, on Wormwood Scrubbs, was described in the "Mechanic," (No. 13, N. S.) in March,* 1839.

J. N.—*The announcement of lectures came too late for insertion.*

A. Z. *will find a letter addressed to him at the "Mechanic" Office.*

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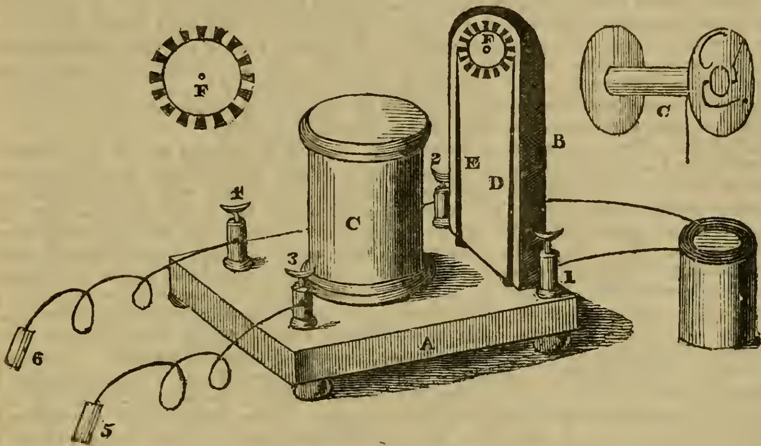
THE

MECHANIC AND CHEMIST.

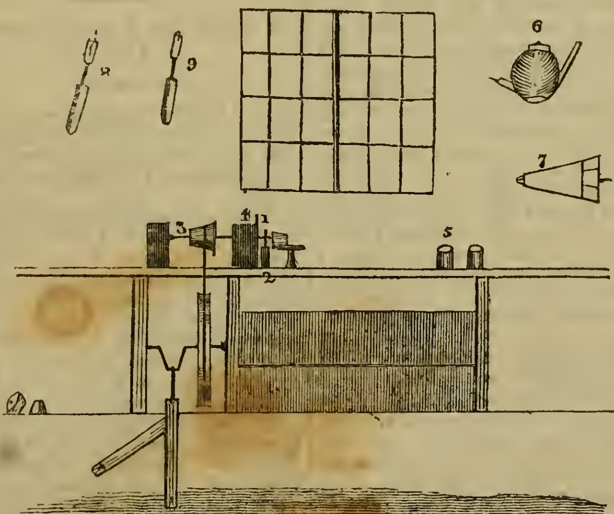
A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 123 & 124, NEW SERIES. | SATURDAY, DEC. 12, 1840. (PRICE TWOPENCE.) | Nos. 244 & 245, OLD SERIES.

ELECTRO-MAGNETIC MACHINE.



POT-MANUFACTORY.



City Press, 1, Long Lane: Doudney and Scrymgour.

ELECTRO-MAGNETIC MACHINE.

(See Engraving, front page.)

A, fig. 1, is a mahogany stand; B, an upright piece, morticed into the bottom; C, the reel or bobbin, on which is wound 300 feet of copper wire, one-twelfth of an inch in thickness, and covered with silk or any resinous substance. The plan I always adopt is, to wind round narrow silk riband in a spiral form, or lay the wire on the riband and turn it over, when it may be tacked along with a needle and thread. I have found this plan much better than the common method of covering, as it will sit much closer together, which is of great importance: this is the primary coil. When the primary coil is finished, you wind round 3000 feet of very fine covered copper wire, one-ninetieth of an inch chain. The best way is, to have this covered by a machine in the usual way, or get it at the philosophical instrument-makers ready covered; where you will get it in separate lengths of about thirty-six yards each, which should be untwisted, and soldered together at every parting. We will now describe the coil, C. In the first place, get a piece of good sound beech, about seven inches long, three inches in diameter; bore a hole through it, one inch and a half in diameter, and turn an arbor to fit it on; then turn the piece down as thin as possible, and fit on the mahogany ends to it. The round ends should be about four inches and a half in diameter, and glued firmly to the central tube, leaving five inches clear, after turning it true; and (French polishing it, if you choose) while yet in the lathe, you wind on 300 feet of stout wire, first passing the end of it through the mahogany, leaving out four or five inches; wind it as close as possible, and as near as you can at right angles to the axis. Having wound all your large wire, bring the end out the same side as you entered; then solder the end of the fine wire to the last round of the stout or primary wire, and wind it the same way as the first: this is termed the secondary coil. Having finished winding it, bring the end out the same way as the others; pull out the centre or arbor, and fit it down on the stand, A, passing the three wires through the bottom, and soldering one end of the stout wire to the binding screw, No. 1, and the other end to the brass spring, E; then connect the brass spring, D, with the screw, No. 2, taking care the wires do not touch one another in crossing; then connect the ends of the fine wire by soldering, with the screws, Nos. 3 and 4. F is a brass wheel for breaking connexion; it is about two inches in diameter, with sixteen dovetail notches cut in, and filled up with bits of box or any other hard wood; the axis passes through the upright, B, and turns with a little wink behind. The brass springs, D and E, gently press on the wheel; one of them behind in constant contact, the other comes up with a fine steel point on the rim, when, by turning the wink, the point passes from the brass to the wood, when a shock is given. You may give sixty or a hundred shocks in a second; but about one turn, or sixteen shocks in a second would be strongest: 5 and 6 are the handles for the shocks. In the centre of the helix, you put a bundle of covered iron wire—such as bonnet-makers use—when the shock is increased tenfold.

I have a machine of the same size as the above, which, with a small pot battery of half-a-pint, will completely fasten a person to the handles, in the most excruciating pain, till the handle is stopt with a pint battery. It would fasten half-a-dozen persons joining hands, and make them dance and twist their bodies in a hundred different contortions, to the no small amusement of the operator, who should stop when bid to do so. With not a very large battery, I doubt not but I could bring a horse or a bullock to the ground. The deflagration of different metals and decomposition of water, are very beautiful. S. CHICK.

A VISIT TO A POT MANUFACTORY.

No. III.

IN our last we proceeded with the formation of the utensils by the thrower; we will now notice the operations of the person who smooths and polishes them—the turner.

The machine at which the turner works, is called a lathe, and resembles, in some respects, the lathe of the wood-turner. Fig. 4 is a representation of the turning-lathe of the potter. The spindle has a screw thread at one end, upon which is screwed a chuck, or, as it is called by the workmen, a chock of wood, tapering in form from the end in which the nut is inserted. The turner is provided with a large number of chucks of different diameters and shapes, in order to fit the various sorts of ware to be turned. The tools used by him are made of iron, and are of various sizes, from a quarter of an inch to an inch and a half in breadth, and

six inches in length; the cutting end is turned up about half-an-inch, and filed to a good edge.

The article to be turned is placed upon the chuck, and the lathe being put in motion by a woman called the lathe-treader, the turner fixes it fast thereto, by pressing a small portion of the top of the article close to the chuck. The turner now proceeds to cut away the superfluous parts, and to bring the vessel to the required shape; after this is done, the motion of the lathe is reversed, and a smooth flat tool being applied with a gentle pressure, the vessel is made quite smooth, and its solidity improved. A small tool is now applied to the top of the article to make it round; it is then removed from the chuck and placed upon a board. This is the way in which a cup, a bowl, or a mug is turned. But there are some articles that pass through the turner's hands several times; tea-pots, for instance, are operated upon four distinct times by the turner. First, they are cut and smoothed, on the outside; next, they are natched; that is, a ridge is made on the inside of the rim for the cover to rest upon; the covers are then turned and placed upon the tea-pots; lastly, when they are become hard, the covers are let down so as to fit the tea-pots exactly. Mustard-pots, sugar-boxes, natched butter-tubs, &c., undergo nearly the same operations.

Some articles of pottery are fluted or checquered; cream-coloured ware and black tea-pots are generally fluted. This effect is produced in what is called an engine lathe, which, in addition to a rotary, gives an horizontal motion to and fro to the article, whereby the turner is enabled to make the requisite incisions at regular intervals. The mechanism of the engine lathe will be understood by a reference to fig. 5. The lathe is turned round by the hand during the process of fluting, and the cog-wheel, moving in connexion with the nickled pulley, enables the workman to make the flutes in the proper required intervals.

The edges of cups and basins are sometimes scolloped; this is done in the following way:—After the vessel to be scolloped has been smoothed and polished, an instrument, called a scolloper—a circular piece of tin moving on an axis, its edge being bent in and out to correspond with the sort of scollop required—is applied to the top of the vessel, with a pressure sufficient to force it through the pot to the chuck; the lathe is then pulled gently round by the lathe-treader. By this means the whole of the edge of the article is scolloped; it is then removed, and a tool being passed over the scollops to make them smooth and round, the article is finished, by passing a wet sponge several times over the scolloped part, to remove any bits of clay that may have adhered to it during the process of scolloping.

A row of beads or other figures is sometimes made round the pots by an instrument resembling a scolloper, called a runner.

An earthenware turner, a turner of lustre and black, a chinaware turner, and a turner of common-coloured ware, are four distinct branches of the turning art. We have just described the operations of an earthenware turner.

The coloured-ware turner is so called, from the making of different figures with various colours upon the pots, before he removes them from the chuck. The articles that are coloured this way are generally basins, jugs, and mugs. The process is as follows:—The article is placed upon the chuck, and turned to the required form; it is then rounded at the top, and left on the chuck. The turner has at hand a number of vessels, each containing a different colour or slip. These vessels have a sort of spout on each side; the cover is fastened on with clay, and made air-tight. Into one spout is inserted a quill, and fastened with a bit of clay; the end of the quill is allowed to protrude a little way. The lathe is turned round slowly, and the turner applying the spout, into which the quill is inserted, to the pot, blows gently down the other spout, thereby forcing the slip out of the vessel upon the article to be coloured. Bands of various breadths are made round the article with different-coloured slips. The middle band is generally the broadest; upon this band the turner pours from a flat vessel—the interior of which is divided into three compartments, each containing a different coloured slip—another band made of a zigzag kind. The article is then removed from the chuck and put to dry.

Coloured ware should always be pretty strong; for the clay, having a great affinity for water, the slip which is put upon it would soon dissolve them, were they not of considerable thickness.

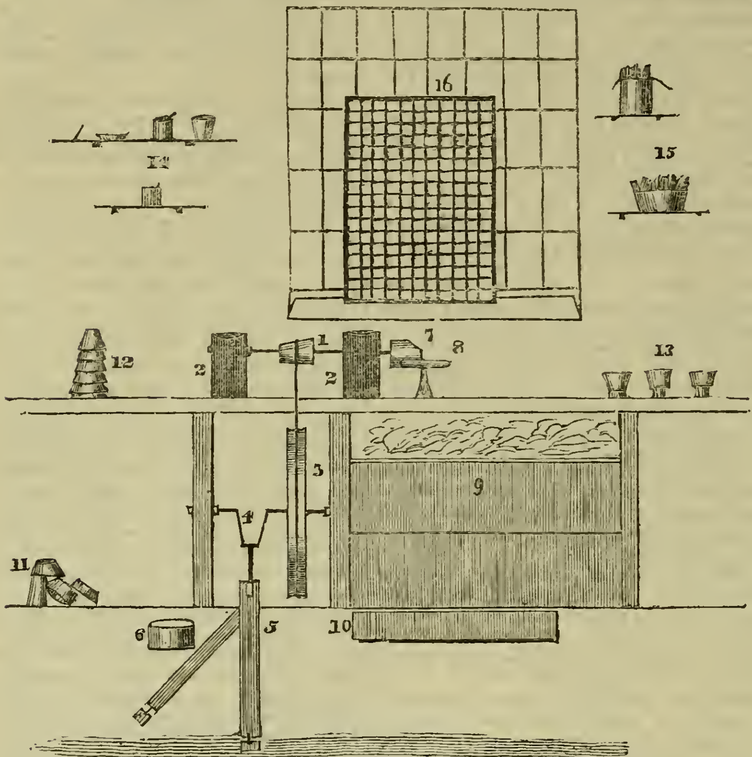
Description of the Engravings.

Fig. 4, a lathe: 1, the spindle; 2 2, uprights, in which the spindle moves; 3, the wheel; 4, the crank; 5, the traddle; 6, a step for the lathe-treader to stand upon; 7, the chuck; 8, the rest; 9, a box for holding the cuttings which come off the pots, called the shaving-box; 10, a board

for the turner to stand upon; 11, chucks; 12, unturned cups; 13, turned cups; 14, oil-cups, &c.; 15, turner's tools; 16, a guard, to prevent the pots breaking the window when they fly off the chuck.

Fig. 5, an engine lathe: 1, the cog-wheel; 2, a rest, containing the nickled pulley; 3, a circular board—the lathe-treader turns the lathe round with the help of this; 4, an instrument for stopping the horizontal motion of the lathe.

Fig. 6, the vessel with two spouts,



mentioned above; it is called a blowing bottle.

Fig. 7, the vessel used in making the zigzag bands with different-coloured slips: it is called a swagging bottle.

Fig. 8, a scolloper.

Fig. 9, a runner. There are several sorts of runners, known to the workmen by the names of gadaroon runner, bead runner, &c.

SCIENCE WITHOUT MYSTERY.

No. I.

OPTICS AND THE PRESERVATION OF THE SIGHT.

INTRODUCTION.

It is a custom which has become, by convention, a prerogative with all writers who presume to address the public, to commence by a few words in their own behalf; and it happens too often that they have much need of an excuse for their impertinence. It is not enough for one who pretends to teach others, that he be well disposed and mean honestly; he must also possess knowledge and judgment, to enable him successfully to accomplish the task he undertakes. Some authors affect much diffidence and modesty, complaining of their own incompetence, and regretting that the work had not been undertaken by abler hands; while they cunningly

magnify the difficulties they have had to encounter, and reluctantly confess that their triumph is complete, and that they have surpassed in excellence all their predecessors; but an old gentleman of evil report says, that his favourite sin is "the pride that apes humility." We all strive to obtain the suffrage and approbation of our readers; a legitimate and laudable object, since the desire of praise often assists in rendering us deserving of it. For my own part, I have little glory to expect from the concoction of a work, which, from its nature, must be considered as little more than a compilation; but if I suggest no new theory, and propound no new doctrine, I have the advantage of being secure from the danger of promulgating false opinions, and interfering with subjects that lead to angry controversy. My object is, to explain the principles and phenomena of the most useful and interesting sciences, in simple and popular language, that may be understood by those who are not initiated in the technical forms of the higher branches of science. By "popular language," I do not mean exclusively the language of the uneducated. This treatise is equally adapted to the use of the Royal and other great families, and to the working mechanic, and all those who have not made a previous study of the more elaborate and abstruse writers, who are justly looked upon as the highest authorities. Having thus explained my intentions, I have only to express a hope that my endeavours, though humble, may not be found entirely useless; and, begging the reader's favourable reception, I will now proceed, without farther preface, to explain

THE PRINCIPLES OF OPTICS.

Optics is the name given to that science which describes the various phenomena of light and vision, and the laws which regulate the passage of rays through transparent substances, and their reflection or dispersion when intercepted by impenetrable obstacles.

Light is a material existence, as is clearly proved by its motion and its action upon inanimate matter, as well as upon the organs of vision; but it does not appear to possess the principal properties which characterise ordinary matter. Rays of light concentrated in the focus of a powerful lens, though moving with a velocity almost surpassing human conception, have not been discovered to communicate any impulse to bodies exposed to their action; it is, therefore, concluded, that light has no mechanical inertia. It also appears that light is not subject to the laws of gravity, as all perfect matter is; for it shows no tendency to be drawn from its course, either by the attraction of the earth, or of any other planet. The most incomprehensible of all the phenomena of light, is its passage through compact bodies, as glass, diamonds, &c.; which seems to prove, that it does not even possess extension, or the property of occupying space; though it is difficult to conceive any existence without it. Light is propagated and transmitted through the regions of space in straight lines, and with uniform velocity. Astronomers have discovered, that when the earth is between the sun and Jupiter, the satellites of that planet are eclipsed about eight minutes sooner than they could be according to calculation; and that when the earth is nearly in the opposite point of its orbit, these eclipses happen about eight minutes later than the calculated tables predict them. Hence it is undeniably certain, that the motion of light is not instantaneous, since it takes about sixteen minutes and a half of time to go through a space equal to the diameter of the earth's orbit, which is at least 190,000,000 of miles; consequently, light must travel at the speed of about 190,000 miles in a second of time.

All visible objects are either sources of light—as the sun, the fixed stars, a flame, &c.—or they are illuminated by the rays emitted by some other body, and transmitted, by reflection, to the eye of the spectator; except in the case of imperfectly transparent bodies, which partially intercept and modify the rays, when such bodies are placed between the eye and the light. That we see objects by their reflection of incident rays which strike upon them, may easily be proved and understood, by observing that we cease to see an object the moment the light which shines upon it is removed or intercepted. This privation of light is called shadow; and, it must be remarked, that though we can see an object indistinctly, in an ordinary shadow, we only see it by receiving the rays reflected from some surrounding objects which are not totally obscured or deprived of light; but, in a perfect shadow, all bodies are entirely invisible; hence, it is evident, that the sensation of vision is caused by the action of rays of light upon the organs destined for their reception.

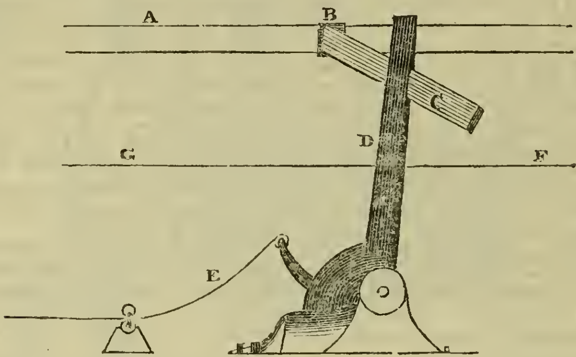
Q. E. D.

(*To be continued.*)

PREVENTION OF RAILWAY ACCIDENTS.

To the Editor of the Mechanic and Chemist.

SIR,—The alarming extent of accidents and loss of life which have occurred of late on the various railways, render it truly lamentable that our laws should be so framed as to put a check upon mechanical improvement, and thereby place the prevention of those accidents almost entirely upon the humanity of inventers. The terrible shock which has been given to the feelings of the nation by these heart-rending occurrences, is a proof that the nation suffers in a ratio with individuals, from the operation of our cruel and wicked patent laws. I do not hesitate to say that, had merit been adequately rewarded, it would not have required so many of these dreadful catastrophes to stimulate and arouse the inventive faculties of a disregarded portion of society to the improvement of railway travelling. When this piece of absolute injustice will cease to exist in our code of laws, I do not know; but that it becomes the duty of every man to lay aside personal interest when human life requires protection, is a fact which our feelings amply demonstrate. I consider the prevention of a great portion of these accidents to be involved in the following principle—viz., in regard to railways, is it possible to place in the object which is at rest, a power by which it shall have a complete and independent control over that which is in motion? To effect this purpose, I propose the following plan, as being the best I can devise at present:—



A is the main egress pipe of the boiler of a locomotive engine; B, a valve, having a long arm, which, when the valve is open, stands at right angles to the line of motion, and, when shut, parallel to it; D, an iron bar, capable of being placed horizontally, or raised perpendicular, so as to come within the range of the arm, C; E is a rope attached to the bar, P, and placed on the ingress line to every station, and of sufficient length to allow the engine time to stop, after the steam has been cut off; F G is the line of motion.

Now it will be evident at a glance, that the engine cannot move without the valve, B, is open; and, if the bar, D, be raised, it would be impossible for it to pass it, without the valve being instantly closed: the station keepers would, therefore, have a power by which they could stop an engine whenever they pleased. This bar might be placed at equal distances along the whole length of the line without ropes; so that if an engineer found himself behind his time, he might stop, raise one of the bars, and then he could proceed in safety. The next engineer, having his steam cut off by this bar, would know at once that there was danger on the line. There might be a permanent bar fixed at a proper distance from the terminus of every line, whereby no engine could enter the terminus station, without having its steam cut off at the proper place.

I remain, &c.

B. T.

Sheffield.

PREVENTION OF RAILWAY ACCIDENTS.

IT is now ten years since the system of railway conveyance was first tested on the Liverpool and Manchester line. The result of that experiment was, perhaps, the most glorious and unqualified triumph ever achieved by human science; and

subsequent and more extensive experience has realized, 'and even surpassed the anticipations of the most sanguine and enthusiastic promoters of that great undertaking. The numerous and fearful accidents which have recently occurred on various lines of railway, lamentable and distressing as they are, especially to the sufferers and their immediate friends, cannot fairly be considered as valid arguments against the principle of steam locomotion. Very few accidents are occasioned by defects in the machinery, and still less by errors in the prescriptions of theory. In all the walks of life, we are surrounded with perils; the mariner is exposed to storms, pirates, famine, scurvy, and mutiny; in cities we are in danger of carts, cabs, coaches, chimneys, scaffoldings, fogs, fires, pickpockets, unclosed cellars, projecting scrapers, and orange-peel on the pavement; in the country, we find lightning, steeple-chasing, bulls, footpads, rioters, precipices, and incendiaries; in the midst of life we are threatened with death; and neither railroads, nor any other human invention can impart to man the right of saying, "to-morrow is mine." But although occasional accidents will ever be unavoidable, we ought not to relax our efforts to prevent them, as far as human foresight will permit. All accidents on railways may be classed under these two heads—mechanical and administrative. Of the former, the chief danger is the liability of engines to run off the rails when passing rapidly over a curved line; for this, we have already proposed a remedy, as effectual in its operation, as it is easy in execution—it is to form the curve on a concave spherical surface, whose radius is proportional to the assumed velocity of the train, inversely, and to the radius of the curve directly. Administrative faults will be best rectified by coroner's juries; heavy deodands, in cases of culpable negligence, will have more effect than all the arguments and expostulation that we, or anybody else, can possibly employ. As this is a subject which will probably occupy the attention of many of our readers, we have collected the following suggestions from various sources.

(From the "Leeds Mercury.")

We understand that Mr. Robert Stephenson, the engineer, is preparing a contrivance for attaching a *self-acting break* to the buffers of every carriage; this would act by the break being applied to the wheel as soon as the buffers of any two carriages came together. In case either of accident or of danger, as soon as the engine-driver turns off his steam, the buffers of the carriages come together; but unless breaks are instantly applied, the momentum of the train carries it a considerable distance before it can be stopped. If, then, a break were instantly and infallibly applied to *every* carriage as soon as the steam was turned off or any check experienced (such as the engine getting off the rails), the whole train at once would be converted into one long *sledge*, and the friction of the rails would bring it to a stand in much less time than is now possible. It seems to us, therefore, that such a contrivance as we have mentioned, will be one of the most valuable improvements that can be adopted on railways.

(From the same.)

I have observed, that when a collision or sudden stoppage of railway carriages takes place, any injury to the passengers generally arises from those sitting with their faces to the front of the train being thrown forward, either against the persons or backs of the seats opposite to them. It therefore appears to me worthy of consideration, in the future construction of railway passenger-carriages for great rate of speed, whether or not, it would be an improvement as regards safety, to make them with *single* instead of double boxes or divisions—that is, instead of a carriage having, for example, three divisions, each division containing two rows of seats opposite to each other, that it should have six divisions, each containing only one bench or row of seats. In this way the passengers would not face each other; and, were the carriages turned each trip, the passengers might sit whichever way the train was going, with their backs to the engine or front f the train. Even were the passengers to *ride forwards*, as it is called, the space between the back and front of the box being so much less than it is on the present plan of double-seated boxes, a passenger, if thrown forward by an unexpected stoppage, could not be so much injured in the narrow as in the wide box, and one passenger could not be dashed against another. The best practice would, however, be, to put the proposed carriages about upon the turning-table each trip, so that the passengers should ride backwards; and when an accident of the kind in question occurred, if the passengers kept their places, I am satisfied that comparatively little injury would be sustained, except in very extraordinary circumstances.

(From the same.)

It has occurred to me, that accidents by

trains being thrown off the rail, by persons wickedly placing obstacles thereon, might be prevented by the iron which precedes the wheels of the engine, being placed so as to remove obstacles on the *inside of the rail*, instead of merely removing what *is actually on* the rail. For instance, if a large stone is placed on the *inside of the rail*, the iron before the wheels of the engine would *not touch* it, because this iron runs exactly parallel with the rail, instead of removing what might be in the way of the flange of the wheel, and also actually higher than the rail.

(From the " Bath Chronicle.")

Let the valve which is used for turning on the steam to the working cylinders be made with a spring, so constructed as, in its action, always to shut off the steam, which in this case blows off through the safety valve. To this spring is connected a leather strap or rein. The engineer, on receiving the usual signal to start, gives the accustomed whistle, pulls the rein, and the steam, which was before blowing off through the safety-valve, is directed to the working cylinders, and will continue so long as the engineer holds the rein ; but should he, from drowsiness or any other cause, relax his hold, the action of the spring immediately shuts off the steam, which, returning again to its former mode of escape, soon gives notice of the absence of the directing hand.

(From the same, by Dr. Wilkinson.)

Protective Plan Proposed.—To impress a sensation of security on the mind of every traveller by railway, is both the interest and duty of the managers of these extensive concerns; and to prevent the results arising from either of the causes above mentioned, I avail myself of this opportunity of submitting to the consideration of the directors, the adoption of a plan which would not be attended with much inconvenience, or any serious expense. It is adding to the present trains the great part of security attached to the atmospherical railway plan. To each locomotive engine let there be attached a strong iron cylinder, about eight feet long, and twelve inches in diameter. Into this cylinder let there be introduced a proportionately strong condensing piston-rod, projecting six feet or more in advance of the engine, and placed exactly in the centre, having the head two feet in diameter. Thus, in case of collision, the two piston-heads would first come into contact, and the progressive condensation of air would counteract the effects of any sudden change of motion. Two cylinders of the above dimensions, if condensed to two feet, would create a resisting power nearly amounting to eight tons. As the disturbing power resulting from one train overtaking another, is no ways so great as the former, the extremity of the train being provided with a strong rod of iron, would be equally well protected, as in the former case, with two cylinders.

A correspondent of the *Times* recommends one or more trucks or carriages to be always kept empty, should be placed at the end of every train, and also, properly ballasted, at the head of the passengers' carriages. Experience having shown, in almost every instance, that an accident is more likely to be fatal to persons in the first or last carriages of a train, than to those who occupy a middle position; it is, therefore, desirable, that the risk should be broken, by falling upon an *inert* material, which might be constructed with this especial view, before reaching the vehicles in which passengers are conveyed.

POWER OF STEAM.

To the Editor of the Mechanic and Chemist.

Sir,—I send you the following for insertion ; if you think it worthy of a place in the " Mechanic," you will oblige,

Yours, &c.

G. Mitchell.

The power of a high-pressure engine is found by multiplying the force of steam in the boiler in pounds per square inch, by the decimal .6; the quotient will be the effective pressure. There is a high-pressure engine in this neighbourhood connected with a water-wheel: when the engine drives all the work, the whole force of steam requisite to drive at full speed, was 18 lbs. per square inch ; but when the water-wheel was connected, a force of 12 lbs. would drive at full speed; hence the difference is 6 lbs. per square inch. Then, by the above rule, the effective pressure, 6 lbs. $\times$. 6 $=$ 3.6 lbs. per square inch. The area of cylinder is 154 square inches, which, multiplied by 3.6 lbs. $=$ 554.4, and this $\times$ 240 feet, the velocity of the pestle of the engine gives 133056 lbs., a foot per minute, and divided by 32000 $= 4\frac{2}{10}$ horses' power, which is the effect of the water-wheel.

Now, in the above experiment, the discharge of water into the buckets of the

wheel was 110 cubic feet per minute, with a fall of 30 feet. To calculate the effect of the above:—According to the deductions of "Smeaton's Experiments," the effect of a water-wheel is .66 of the power of the water: a cubic foot of water weighs $62\frac{1}{2}$ lbs.; this, multiplied by the decimal $.66 = 41\frac{1}{4}$—say 41 lbs.; then 110 cubic feet, as above, multiplied by 41 lbs. = 4510, and by 30 feet fall = 185300 lbs.; this, divided by $32000 = 4\frac{2}{10}$, or rather more than the effect found by the engine as above. If the decimal for a condensing engine be compared in the same way, it will be found correct. See page 230 of this work.

COOKSON'S PATENT PROCESS FOR OBTAINING COPPER AND OTHER METALS FROM METALLIC ORES.

(Abstract of Specification.)

This invention is applicable to those metallic ores which contain copper in combination with sulphur—which, for the purpose of reference, I call sulphureous ores—and also to those which contain copper in combination with oxygen, which, for the purpose of reference, I call oxide ores; and it consists in obtaining copper and other metals, and sulphuretted hydrogen gas, and sulphurous acid, from these sulphureous ores, and in obtaining copper from these oxide ores. The sulphureous ores contain iron in combination with the sulphur, and sometimes small quantities of silver; and the oxide ores also sometimes contain small quantities of silver.

In my first process, I use those sulphureous ores which contain a large proportion of iron and sulphur, and a small proportion of earthy matter; and, for the purpose of reference, I call these ores rich sulphureous ores. I reduce sulphuret of iron contained in these ores to proto-sulphuret, by distilling sulphur from such sulphuret. I then dissolve iron contained in the proto-sulphuret by muriatic acid or sulphuric acid, and thus obtain sulphuretted hydrogen gas and iron, in the state of muriate or sulphate of iron, as the case may be. The sulphuret of copper and the silver (if the ore employed contained silver) remain undissolved, and metallic copper may be obtained from this sulphuret, by the means usually employed to obtain metallic copper from native copper ores, but by the means hereinafter described; for these purposes I obtain from the undissolved residuum, metallic copper and sulphurous acid, and also silver, if the sulphureous ore employed contained silver.

In my second process, I roast the sulphureous ores at a bright-red heat, while they are exposed to the action of atmospheric air, until the sulphurets of iron and copper, which such ores contain, are converted into oxides; and by mixing the roasted ores with muriatic acid, I dissolve the oxide of copper, and obtain muriate of copper, from which metallic copper may be obtained.

In my third process, I also roast the sulphureous ores at a bright-red heat, while they are exposed to the action of atmospheric air; but I discontinue this roasting when the greater part of the sulphuret of iron has been converted into oxide. The copper remains in the state of sulphuret, and, by exposing the roasted ores to the action of atmospheric air at a suitable heat, I convert this sulphuret into sulphate, and the remaining sulphuret of iron becomes oxidized. I then separate the sulphate of copper by dissolving it, and thus obtain oxide of iron (from which metallic iron may be obtained) and sulphate of copper, from which I obtain metallic copper and sulphurous acid.

In my fourth process, I roast the sulphureous ores in the same manner as in my third process, until about one-half of the sulphuret of iron has been converted into oxide; no part of the sulphuret of copper being converted into oxide. I then flux the roasted ores in mixture with carbonaceous matter, and thus obtain a regule containing sulphuret of iron in the state of proto-sulphuret (capable of being decomposed by acid), and sulphuret of copper and also silver, if the ore employed contained silver. I then dissolve iron contained in the regule by muriatic acid or sulphuric acid, and thus obtain sulphuretted hydrogen gas and muriate or sulphate of iron, as the case may be. The sulphuret of copper and the silver (if the ore employed contained silver) remain undissolved; and metallic copper may be obtained from this sulphur by the means usually employed to obtain copper from native copper ores, or this sulphuret of copper may be converted into sulphate of copper and metallic copper, and sulphurous acid obtained therefrom, by the means mentioned for these purposes in describing my third process; and in such case silver (if the sulphureous ore employed contained silver) may be obtained from the residuum remaining after the sulphate of copper has been dissolved. If the sulphureous ore employed did not contain silver, I use the sulphuret of cop-

per obtained in this my fourth process, to mix with sulphate of copper, as mentioned in describing my third process, instead of converting it into sulphate.

The fifth process is applicable only to the oxide ores. By digesting these ores with muriatic acid or sulphuric acid, I dissolve oxide of copper, and obtain either muriate of copper (from which metallic copper may be obtained) or sulphate of copper, from which metallic copper and sulphurous acid may be obtained, by the means mentioned for that purpose in describing my third process.

I will now describe more particularly, the manner in which I carry my several processes into effect.

In carrying into effect my first process, I put the rich sulphureous ore which I employ, into an oven or retort, constructed of fire-bricks or fire clay, in a manner similar to the ovens or retorts constructed of such materials which are used for distilling gas from coal; and I apply heat to such oven or retort, in the same manner as heat is applied in making coal gas. I thus subject the ore to a red heat to distil off sulphur; but care must be taken to avoid raising the heat to such a temperature as will cause the ore to become fused; and I continue this heat until nearly the whole of the sulphuret of iron contained in the ore is reduced to proto-sulphuret. I then withdraw the ore from the oven or retort, and put it into a vessel (which I prefer to construct of lead or of wood), fitted with a gas tube for conveying off gas, and with pipes for supplying steam and muriatic acid or sulphuric acid; and after I have closed this vessel air tight, I introduce muriatic acid or sulphuric acid into it; and I inject steam into the liquid to assist the action of the acid. The proto-sulphuret of iron is decomposed by the action of the acid, sulphuretted hydrogen gas passes off through the gas tube into a gasometer, and I obtain muriate or sulphate of iron (as the case may be) in solution. I then draw off the solution and wash the residuum with water, or separate a farther quantity of muriate or sulphate of iron. This residuum contains sulphuret of copper and also silver (if the sulphureous ore which I employed contained silver), and metallic copper may be obtained from this sulphuret, by the means usually employed to obtain copper from native copper ores, or otherwise metallic copper and sulphurous acid, and also silver (if the sulphureous ore employed contained silver) may be obtained from the residuum.

In my second process, I put the sulphureous ore into an oven or furnace, which has a current of atmospheric air through it; and I roast the ore in this oven or furnace at a bright-red heat. If the ore which I employ is in powder, I either continue this roasting until the sulphurets are completely converted into oxides, or when a great portion of the sulphur contained in the ore has been driven off, I remove the roasted ore to a common reverberatory furnace, and complete this conversion in such furnace by the action of atmospheric air at a red heat; but if the ore which I employ is not in powder, then I find it necessary to pulverize the ore, when a great portion of the sulphur has been driven off, and afterwards to complete the conversion of the sulphurets into oxides, by the means before mentioned for that purpose. After the sulphurets have been thus completely converted into oxides, I mix the roasted ore with muriatic acid, and thus dissolve the oxide of copper; and I assist this solution by frequently stirring the mixture. I then draw off the solution, and I obtain metallic copper from this solution, either by decomposing the muriate of copper which it contains by metallic iron, or by the other means hereinafter described, for obtaining metallic copper from solutions of copper by means of lime.

In my third process, I roast the sulphureous ore, which I employ in the same manner as I have already mentioned, in describing my second process; and I use a similar oven or furnace for that purpose; but I withdraw the roasted ore from such oven or furnace, when the greater part of the sulphuret of iron contained in the ore has been converted into oxide, and before any part of the sulphuret of copper is converted into oxide. And, if this roasted ore is not already in powder, I pulverize it; I then put it into an oven or furnace, through which a current of atmospheric air is passing, and heat it until it attains such a red heat, as is just perceptible in the absence of day-light. I thus cause the sulphuret of copper contained in the ore, to absorb oxygen from the current of atmospheric air passing through the oven or furnace; and, in order to promote this absorption, I frequently rake the ore during the operation, for the purpose of exposing fresh surfaces to the action of the atmospheric air. I continue this operation until the sulphuret of copper is converted into sulphate, and I then lixiviate the product of the operation with water, and thus dissolve the sulphate of copper; and I draw off this solution and wash the residuum, to separate a farther quantity of

sulphate of copper. Metallic copper may be obtained from the solution of sulphate of copper obtained by these means, either by precipitating copper by means of metallic iron, or by precipitating oxide of copper from the solution by means of cream of lime, and afterwards washing such oxide with water to separate the sulphate of lime; and mixing the oxide thus washed with carbon, and then reducing the oxide into metallic copper, by exposing this mixture to a high temperature. But I obtain metallic copper and also sulphurous acid from this solution of sulphate of copper. For this purpose I evaporate the solution to dryness, and mix the dry sulphate with half its weight of the sulphuret of copper obtained by my fourth process. I pulverize this mixture, and expose it to a red heat in a closed retort or oven (which I prefer to construct of fire-clay or fire-brick), and thus drive off sulphurous acid suitable for the manufacture of sulphuric acid. The residuum in the retort or oven contains a great proportion of metallic copper and some oxide of copper; and I separate oxide by washing the residuum with water, or by dissolving oxide by muriatic acid or sulphuric acid; and I afterwards melt the residuum with suitable fluxes to obtain metallic copper; or, otherwise, I obtain metallic copper from the residuum, by fluxing it as it is taken from the retort or oven, in mixture with carbonaceous matter and suitable fluxes. If the ore is not heated in the operation of converting sulphuret of copper into sulphate, to a temperature exceeding such a red heat as is above described, the sulphate will not become decomposed; but if such ore is heated to a temperature much exceeding such red heat, a portion of the sulphate will become decomposed, and be converted into oxide of copper; and, in this case, this oxide may be extracted from the residuum by dissolving the oxide by muriatic acid; and metallic copper may be obtained from such solution by precipitation with iron, or by means of lime, in the manner hereinbefore described for obtaining metallic copper from a solution of sulphate of copper, by means of iron or lime. The residuum which remains, after dissolving and separating the sulphate of copper and the oxide of copper (if any such oxide has been produced), contains oxide of iron, from which metallic iron may be obtained, by the means usually employed for obtaining metallic iron from native oxide of iron.

In my fourth process, I also roast the sulphureous ore, which I employ in the same manner as I have already mentioned in describing my second process; and I use a similar oven or furnace for that purpose, and I withdraw the roasted ore from such oven or furnace, before the sulphuret of copper is converted into oxide; but I prefer to withdraw it as soon as about one-half of the sulphuret of iron has been converted into oxide of iron. I ascertain the proportion of iron which the roasted ore contains, and for every four parts of iron contained therein, I add one part of powdered coke or coal. And, for the purpose of assisting the fluxing of the ore, I add fluxes to the powdered coke or coal and roasted ore; and I regulate the quality and quantity of the fluxes which I employ, in the same manner and upon the same principles as these are regulated in the ordinary operations of copper smelting. I mix together the roasted ore, the coke or coal, and the fluxes, and I put the mixture into a furnace, similar to the furnaces which are used for fluxing in the ordinary operations of copper smelting; and I cause the mixture to become fluxed, in the same manner as fluxing is usually effected in these operations. I thus obtain a slag or scoria, consisting of the earthy matters which were contained in the ore, and a regule containing proto-sulphuret of iron (capable of being decomposed by muriatic acid or sulphuric acid) and sulphuret of copper, and also silver, if the sulphureous ore employed contained silver. When the mixture has been completely fluxed, I cause the regule to run off from the fluxing furnace into water, for the purpose of granulating it; and, when it has been thus granulated, I prefer to powder it, and I put it into a vessel (which I prefer to construct of lead or of wood) fitted with a gas-tube for conveying off gas, and with pipes for supplying steam and muriatic acid or sulphuric acid; and, after I have closed this vessel air tight, I introduce muriatic acid or sulphuric acid into it, and I inject steam into the liquid to assist the action of the acid. The proto-sulphuret of iron is decomposed by the action of the acid, sulphuretted hydrogen gas passes off through the gas-tube into a gasometer, and I obtain muriate or sulphate of iron (as the case may be) in solution; I then draw off the solution and wash the undissolved residuum with water, to separate a farther quantity of muriate or sulphate of iron. This residuum contains sulphuret of copper and also silver (if the sulphureous ore which I employed contained silver); and metallic copper may be obtained from this sulphuret by the means usually employed to obtain copper from native copper ores;

but I prefer to convert sulphuret of copper, thus obtained, into sulphate, and to obtain metallic copper and sulphurous acid from such sulphate, by the means which I have already described for these purposes in describing my third process. When the sulphuret of copper is converted into sulphate, and this sulphate is dissolved, and the solution drawn off, the undissolved residuum contains such silver as was present in the sulphureous ore employed; and silver in a metallic state may be obtained from this residuum, by some of the processes usually employed for extracting silver from silver ores. If the sulphureous ore which I employ in this my fourth process, does not contain silver, then I use the sulphuret of copper, obtained in this process, with dry sulphate, as described in my third process.

In my fifth process, I use only the oxide ores. I reduce the ore which I employ to powder, and then mix it with muriatic acid or sulphuric acid; and I assist the action of the acid employed, by injecting steam into the mixture. I thus dissolve the oxide of copper contained in the ore, and obtain muriate or sulphate of copper (as the case may be) in solution. If muriatic acid has been used, I obtain metallic copper from the solution of muriate of copper by means of iron or lime, as mentioned, for the purpose of obtaining metallic copper from solution of sulphate of copper by iron or lime, in describing my third process. And if sulphuric acid has been used, I obtain metallic copper and sulphurous acid from the sulphate of copper, by the means which I have hereinbefore described, for obtaining metallic copper and sulphurous acid from sulphate of copper, in describing my third process.

SALT.

An analysis of various kinds of foreign and domestic salt was made, some years ago, by Dr. Henry, of Manchester, in order to ascertain the respective purity of each. From his experiments it appeared, that that called the fishery salt, produced in Cheshire, contains $983\frac{3}{4}$ parts of pure muriate of soda in 1000, the remaining $16\frac{1}{4}$ parts being chiefly of sulphate of lime. The salt formed by simply crushing the rock of the Cheshire mines, is little inferior in purity, being $983\frac{1}{4}$ parts of muriate of soda to $6\frac{1}{4}$ sulphate of lime, 10 of insoluble earthy matter, and various minute proportions of muriates and sulphates. The Scotch common salt has only $935\frac{1}{4}$ of pure muriate of soda, to 28 of muriate of magnesia, 4 of earthy matter, 15 sulphate of lime, and $17\frac{1}{4}$ sulphate of magnesia. The French salt varies in purity between the common or Scotch salt, and the Cheshire kinds.

Salt crystallizes in cubes, which are sometimes grouped together in various ways, and, not unfrequently, form hollow quadrangular pyramids. In fire, it decrepitates (burns till it has ceased to crackle), melts, and is at length volatilized. When pure, it is not deliquescent (will not dissolve) One part is soluble in $2\frac{1}{2}$ of cold water, or in little less of hot; so that it cannot be crystallized but by evaporation.

Salt is indispensable to man, as a component part of his food. It is stated, that with every bushel of flour, about one pound of salt is used in making bread; and thus, it may be presumed that, in bread alone, every adult consumes about two ounces of salt weekly. The omission of a proper quantity of it in our food favours the engendering of worms. We read, that when the ancient laws of Holland ordained men to be kept on bread alone, unmixed with salt, as the severest punishment that could be inflicted upon them in their moist climate, the effect was horrible; the wretched criminals are said to have been devoured by worms. Mungo Park mentions that he suffered great inconvenience from the scarcity of this article :—" The long use of vegetable food creates so painful a longing for salt, that no words can sufficiently describe it." Almost all graminivorous animals seem to have the same necessity for the use of salt in their food as man. An immunity from the rot is generally enjoyed by sheep fed on the salt marshes, or when salt is regularly mixed with their food. (See Reports of Lord Somerville.) In the States of La Plata, in South America, the sheep and cattle, where they discover a pit of salt clay, rush to feed upon it; and, in the struggle, many are trodden to death. In Upper Canada, the cattle have abundance of wild pasture to browze on in the woods; but once a-fortnight they return to the farm of their own accord, in order to obtain a little salt; and, when they have eaten it, mixed with their fodder, return again to the woods. Salt is now used extensively in England and in all Europe, for fattening cattle. In Spain, they attribute the fineness of their wool to the quantities of salt given to the sheep. In England, 1000 sheep consume at the rate of a ton of salt annually. About 1,000,000 tons are annually given to animals in this country.

Salt is antiseptic—that is, it counteracts putrefaction. This property is valuable, inasmuch as it enables the superabundant

productions of our country to be transmitted, in a sound and wholesome state, to a distant land. It must be borne in mind, however, that salt, when employed as a means of preserving meat, hardens it, and impairs its nutritive power, as well as renders it more difficult to digest. Such meat is less nourishing, but more stimulating, than fresh meat; and its long-continued use produces what has been termed the *disjunctive* inflammation, owing to which, old wounds, &c., break open, and fractured bones separate after re-union.

C. DAVIDSON.

(To be continued.)

BLACKWALL RAILWAY.

THE following may serve as a useful hint to those who have claims upon railway and other chartered companies, for property required in the construction of public works.

In arranging for the property on the extension line of the Blackwall Railway, between the Minories and Fenchurch Street, the Company have only yet had to issue seven precepts for the summoning of juries, and the result is as follows:—

	Claimed.	Granted.
Boulton and Watt, engineers, Fenchurch Street	£810	£240
William Claridge, wine merchant, Gould Square	3401	800
Grant Preston, brazier, Minories	3611	1500
Samuel Smith, oilman, Crutched Friars	1736	750
William Chillingworth, wine-merchant, Gould Square	3972	1000
W. A. Seal, wholesale clothes salesman, Minories	2652	1500
John Jonas, carman, Crutched Friars	1626	210
Total	£17,808	£6000
Making a difference of		£11,808 !

It is beyond the duty of a good citizen to injure his own family for the promotion of any object of slight national benefit; but when we see persons attempting to take unfair advantage, by making exorbitant and unconscionable demands, we cannot help rejoicing to find their purpose defeated by the interposition of a jury. The above facts clearly show the liberal dealing of the Company, who have only claimed the protection of a jury, in cases of the grossest attempts at extortion.

ECONOMY OF FUEL.

To the Editor of the Mechanic and Chemist.

SIR,—As the time of year is come that fuel is a very valuable article, and, I think, particularly so in London; I beg to offer for your insertion a plan I have adopted to save fuel—you know, to save is to gain: you cannot imagine the quantity that is thrown away every day in large towns. I find the smallest bits of ashes, when the dust is shaken from it, will burn and make good fires, especially with a little fresh coals in front. I have a sieve made ten holes each way—that is, one hundred holes to the square inch—to shake the ashes in; what goes through is dust, and all that stay in the sieve will make good fuel. I think a little box might be made with a sieve in it, so as to just turn a handle, and the ashes would be sifted in the box clean from dust, and have drawers for the coal ashes and one for dust.

Tavistock. A. S.

[This is practised by many in London, though neglected by others; it prevents considerable waste, and, we trust, that the hint will prove serviceable to some portion of our readers.—ED.]

MISCELLANEA.

Curious Phenomenon.—Change of Colour.—A portrait of a celebrated theologian had been painted some years by an artist who was known to have considerable skill in the management of his materials. The very reverend individual was represented in a rich velvet dress, which was not a little admired, and which attracted the eye of the spectator almost more than the face. The picture, however, from the effect of dust and the smoke of lamps, had lost much of its original vivacity. It was, therefore, placed in the hands of a painter, who was to clean it, and give it a fresh coat of varnish. This person began his operations by carefully washing the picture with a

sponge; no sooner, however, had he gone over the surface once or twice, and wiped away the first dirt, than, to his astonishment, the *black velvet* dress changed suddenly to a *light-blue plush*, which gave the ecclesiastic a very secular, though somewhat old-fashioned, appearance. The painter did not venture to go on with his washing; he could not comprehend how a light blue should be the ground of the deepest black, still less how he could so suddenly have removed a glazing colour capable of converting the one tint into the other. At all events, he was not a little disconcerted at having spoiled the picture to such an extent. Nothing to characterise the ecclesiastic remained, but the rich-curled round wig, which made the exchange of a faded plush for a handsome new velvet dress, far from desirable. Meanwhile, the mischief appeared irreparable, and the good artist, having turned the picture to the wall, retired to rest with a mind ill at ease. But what was his joy next morning. when, on examining the picture, he beheld the black velvet dress in its full splendour. He could not refrain from again wetting a corner, upon which the blue colour again appeared, and after a time vanished. On hearing of this phenomenon, I went at once to see the miraculous picture. A wet sponge was passed over it in my presence, and the change quickly took place. I saw a somewhat faded, but decidedly light-blue plush dress, the folds under the arm being indicated by some brown strokes. I explained this appearance to myself by the doctrine of the semi-transparent medium. The painter, in order to give additional depth to his black, may have passed some particular varnish over it; on being washed, this varnish imbibed some moisture, and hence became semi-opaque, in consequence of which, the black underneath immediately appeared blue.—*Goethe's Theory of Colours.*

Magnificent Clocks.—Two very extraordinary clocks were, some time ago, presented by the East India Company, to the Emperor of China, being entirely manufactured by British artists. The Chinese entertain a peculiar prejudice, that all works of art, and ornamental objects, should be in pairs; a pair of pictures, with them, must not merely represent similar subjects, but they must be exactly alike in every detail, except that they will sometimes allow them to be reversed, as a copper-plate would be compared with an impression taken from it. They will not buy a single watch, but must have two exactly alike; one hanging at each side of them: and the same whim extends to shells and almost every object esteemed for beauty or ornament, whether natural or artificial. In conformity with this puerile *taste*, it was necessary to present his Celestial Majesty with two clocks. They were in the form of chariots, each of which contained a lady seated, leaning her right hand on a part of the chariot, under which was a clock, little larger than a shilling, that struck, repeated, and went for eight days without requiring winding-up. A bird was on the lady's finger, finely modelled, and set with diamonds and rubies, with its wings expanded as if to fly, and which was made to flutter for a considerable time, on touching a diamond button. The body of this curious bird, which contained the machinery which animated it, was less than the sixteenth part of an inch. In the lady's left hand was a golden tube, with a small round box on the top, to which was fixed a circular ornament, set with diamonds, which went round in three hours. A double umbrella was over the lady's head, supported by a small fluted pillar, and under which was a bell that struck the hour, though apparently unconnected with the clock; and at the lady's feet was a golden dog, before which were two birds, set with precious stones, and apparently flying away with the chariot, which, from another secret motion, is contrived to run in any direction; while a boy appears to push it forward. There were also flowers, ornaments, and a flying dragon, all set with precious stones, or formed of them; and the rest was made of gold, most curiously executed, and presenting a wonderful specimen of ingenuity and talent.

Cotton Mills of Messrs. Birley and Co., at Manchester. 1839.—The number of hands employed by this firm is 1600, whose wages annually amount to the sum of 40,000*l.* The amount of moving power is equivalent to the labour of 397 horses. The number of spindles in the mills is about 80,000. The annual consumption of raw cotton is about 4,000,000 lbs. weight. The annual consumption of coal is 8000 tons. It will perhaps excite surprise, in a person unacquainted with the nature of machinery, when informed that the annual consumption of oil, for the purpose of oiling the machinery, is about 5,000 gallons; and the consumption of tallow, for the same purpose, 50 cwt. The annual cost of gas is 600*l.* One room alone, belonging to this firm, contains upwards of 600 power looms. The establishment in which the fabric is manufactured for water-proof clothing—such as Macintosh cloaks—belongs to Messrs. Birley and Co., and is part of their concern. The number of hands employed in this business varies from 200 to 600. The immense amount of 250,000 lbs. weight of India-rubber is annually consumed in the process of manufacture: to dissolve which, 100,000 gallons of spirit are employed.—*Guide to Manchester.*

Violet-coloured Gas.—Put three or four grains of iodine into a small test tube, and seal the other extremity of the tube hermetically. If the tube be gently warmed over a candle, the iodine becomes converted into a beautiful violet-coloured gas or vapour, which condenses again into minute brilliant metallic crystals of a blueish-black colour, when the tube is suffered to grow cold; and this experiment may be repeated with the same tube for any number of times.

To produce an Orange-coloured Flame.—Put muriate of lime, deprived of its water of crystallization, into an iron ladle; cover it with spirits of wine, and cause it to burn in the manner stated. To prepare muriate of lime, dissolve common marble in muriatic acid, and evaporate the solution to perfect dryness.

To produce Yellow Flame.—This may be effected by most of the muriates, as common salt, or by nitre, when the salts are added in the proportion of three parts of common salt or nitre to

one of alcohol; the flame produced is a dim yellow.

To produce any Emerald-green Flame.—Cause alcohol to burn in a ladle upon nitrate of copper; let copper clippings or filings be dissolved in a sufficient quantity of nitric acid of a moderate strength; when no farther effervescence ensues, boil the acid gently upon the copper until a pellicle appears; decant the solution evaporated slowly, and, when a very strong pellicle is formed, suffer it to crystallize; the salt is of a fine blue colour.

Easy Method of Breaking Glass in any required Direction.—Dip a piece of worsted thread into spirits of turpentine; wrap it round the glass in the direction you require it to be broken; then set fire to the thread: or apply a red-hot wire, a quarter of an inch thick, round the glass, and if it does not immediately crack, throw cold water upon it while the wire remains hot. By this means, glass that is broken may often be fashioned and rendered useful for a variety of chemical purposes.

Singular Instantaneous Crystallization.—Make a concentrated solution of sulphate of soda or Glauber's salt, by adding portions of it gradually to water kept boiling, till this fluid dissolves no more (half-an-ounce of boiling water will dissolve about two ounces of salt); having done this, pour the solution while boiling hot into common medicine phials previously warmed, and immediately cork them, or tie slips of wetted bladder over the orifice of the phials, to exclude the access of air to the solution; this being done, set the phials by in a quiet place, without shaking. The solution will cool to the temperature of the air, and remain perfectly fluid; but the moment the cork has been drawn, and atmospheric air becomes admitted, it will begin to crystallize, on its upper surface, in fine satin-like crystals, which shoot downwards in a few seconds, like a dense cloud; as so much heat becomes evolved, as to make the phial very sensibly warm to the hands. When the crystallization is accomplished, the whole mass is usually so completely solidified, that, on inverting the vessel, not a drop of it falls out. If the crystallization should not immediately ensue on opening the phial, the slightest agitation, or the dropping in a minute crystal of the same salt, or by merely touching it with it, will generally cause the crystalline process to take place. It may be observed, that the same mass of salt will answer any number of times the same purpose; all that is necessary to be done is, to place the phial in boiling water. All the salt is again completely liquified and corked up as before.

Indelible Ink.—Take oil of lavender 200 grains; gum copal, in powder, twenty-five grains, and lamp-black from two and a half to three grains; with the aid of a gentle heat dissolve the copal in the oil of lavender, in a small flask or phial, and then mix the livigated lamp-black with the solution; after a repose of some hours, the ink must be shaken, before used, or stirred with an iron wire, and, if too thick, it must be diluted with a little oil of lavender. This composition, which was first recommended by Mr. Close, is very useful in chemical laboratories for writing with it the labels of bottles containing acids, or such bottles as are exposed to the acid fumes in a laboratory. W. E., Jun.

To make a Bengal Light.—Nitre, 8 oz.; sulphur, 6 oz.; red lead, 4 oz.; powder, 2 oz.

Blue Fire.—Antimony, 2 oz.; sulphur, 4 oz.; nitre, 6 oz.

Red Fire.—Nitrate of strontian, 2 oz.; sulphur, 4 drachms; antimony, 2 drachms and 2 grains; charcoal, 1 scruple and 12 grains; oxymuriate of potass, 1 drachm 1 scruple.

Another Receipt.—Nitrate of strontian, 2 oz.; chlorate of potass, 6 dwts.; charcoal, 6 dwts.; powder, 6 dwts.

China Gerb Fire.—Powder, 8 oz.; nitre, 2 oz.; steel dust, 5 oz.

White Fire.—Nitre, 1 lb.; sulphur, 11 oz.; black antimony, 3 oz.; red antimony, ½ oz.

Flower Pot.—Coal, 1 oz.; nitre, 1 oz.; sulphur, 1 oz.; powder, 2 oz.

E. C. B. H.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, December 17, Cowden Clarke, Esq., on Butler. At half-past eight.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 16, Conversazione. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, December 15, Major Beniowski, on Mnemonics.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 14, Discussion. At half-past eight precisely.

QUERIES.

In looking over some of your back Numbers, I saw a receipt for painting a winter scene, so that, on holding it to the fire, it turned to summer. The ingredients were muriate of copper, muriate of cobalt, and acetate of cobalt. Now, I want to know if you, or any of your correspondents, can inform me where I can purchase the above; whether at a chemist's or colour warehouse, or elsewhere? For, supposing that I could get them at a chemist's shop, I went into rather a large one, where there was a young roll-em-up, who (by dint of reading all the inscriptions on the drawers and dummies, and labels on the bottles) knew the names of all the ingredients in common use; but when I asked for muriate of copper, he very confidently assured me that he did not believe that there was such a thing. This putting me in a query, induced me to write to you for information. If any of your correspondents will stoop through a maze of learning to inform a young ignoramus how to paint or stain glass, for

a magic lantern, I should be much obliged to them.

J. W.

What is the most adhesive cement by which to fix wood firmly to brass? Putty will not answer my purpose, remaining too long soft. What metals, besides iron and steel, does the magnet attract; and for which of the metals does the magnet not show any inclination? Will the coming in contact with any of the latter injure a magnet? Perhaps some correspondent replying to the latter questions may favour me with the greatest weight a magnet (single or several combined) has been known to lift—what the probable price of such a magnet may be—and where the best and cheapest, large and prepared magnets can be purchased? NOVICE.

A receipt for making a liquid for steeping seed-wheat in, previous to sowing, that will effectually prevent smut, rust, blight, and other diseases to which it is liable; and at the same time to add a fertilizing property to the grain, and assist its germinating? 2. What are green and yellow basilicon made of; and how are they made? 3. A receipt for making the best kind of black Japan varnish for leather, that will remain as durable as the leather itself? 4. How are eclipses of the sun and moon calculated with the utmost exactness? 5. A receipt for making a tincture or mixture of oils, for applying to fresh wounds, such as cuts, scratches, bruises, abrasions, &c., which mechanics who work with edge-tools, are always liable to? 6. Which is the best work known, on making and using all kinds of paints, colours, oils, and varnishes?

D. E. M. S.

[Several of the foregoing queries it will be found difficult or impossible to answer, to the full extent required; but as they are not devoid of general interest, we insert them, with the hope that they may elicit some information from those of our correspondents who are conversant with the subjects referred to.—ED.]

To make the best scarlet water-colour; and if there is any way of dissolving vermilion red in gum-water; and how to extract the most colour from Brazil wood, and the best mordant to brighten the colour.

THOS. SIMMONS.

ANSWERS TO QUERIES.

A correspondent, in your 116th Number, wishes to have a description of the different pipes in hand (barrel) organs. In answer to which I beg to inform him, that it depends entirely upon what stops he intends having in his organ; as there are nearly as many different kinds as there are days in the year, all requiring different dimensions; but, for his information, I will just select three of the most commonly used—viz., open diapason, principal, and fifteenth, all of which are usually made of metal, but can be made of wood. The note middle C, of the principal, measures eleven inches from the mouth upwards, the size of the foot being of no consequence whatever; its use is to carry wind to the other part. The same note in the open diapason measures twenty-two inches, it being an octave lower than the principal; and middle C, of the fifteenth, measures five-and-a-half inches, it being an octave higher than principal; and every octave above being half the length of its predecessor, and every octave below double the length. The width of the pipe is not material, providing the pipes in the same stop bear a certain proportion to each other—viz., that every pipe should be two-thirds the diameter of its octave below; and so of the rest.

W. W.

To make Burnt Steel fit for Use.—As I am in the habit of using that article, in many instances I have over heated the steel, and thereby, to appearance, spoiled it. The following directions will, I think, answer "A. M. A.'s" purpose:—If the steel is rendered coarse by over heat, put it into the fire, bring it to a blood-red heat, quench it in water, repeat the operation six times, and the steel will be brought back to its former state, and fit for the finest work. Be sure that it is hardened each time of quenching, but at the lowest possible heat, otherwise the experiment will fail. WM. SERVICE.

TO CORRESPONDENTS.

W. W.—*The furnace required for casting articles in brass, not exceeding six or eight pounds may be about eight inches square, and two feet deep. To prevent the crucible from cracking, put it into a slow fire with its bottom upwards; coke it up, and let it remain till it becomes red hot, and then place it in its proper position, and when the fire is well up, put in the metal. Brass is injured by exposure to too great a heat, or by remaining too long in a state of fusion; the zinc which enters into its composition is liable to fly off.*

A. C.—*All liquid blacking that we have seen, is subject to deposit the solid ingredients at the bottom of the bottle; this might be partly prevented, by the addition of some gummy substance or size; but it is not necessary, if care be taken to mix it properly at the time of using it.*

J. Banks.—*The question he proposes, has already been discussed and settled in the "Mechanic." No operation of multiplying can possibly be performed, unless one or both of the quantities involved be abstract numbers—say* $19, \frac{19}{20}, \frac{11}{240}$, *and* $\frac{3}{960}$, *and all difficulty vanishes; but if the different amounts represent different things and different values, the question is absurd, and admits of no rational answer.*

T. B.—*No reward is offered for perpetual motion. We will endeavour to obtain the other information he desires.*

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MECHANIC AND CHEMIST.
A MAGAZINE OF THE ARTS AND SCIENCES.

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SUBMARINE STEAM-VESSEL.

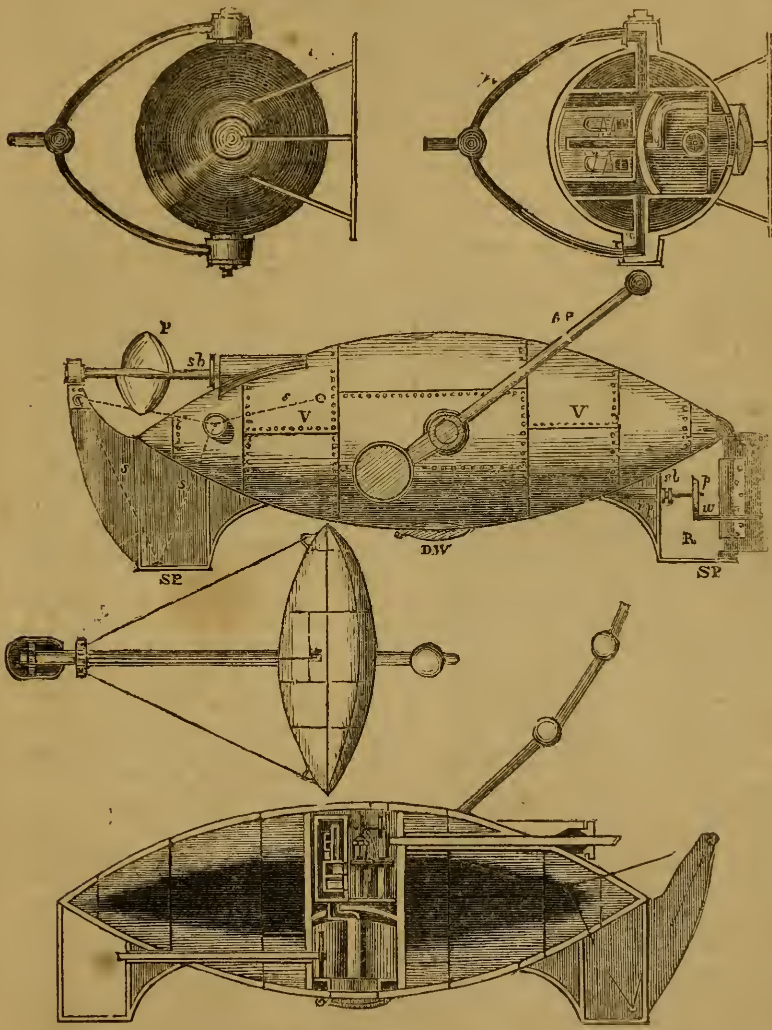


FIG. 6.

 City Press, 1, Long Lane: Doudney and Scrymgour.

SUBMARINE STEAM-VESSEL.

(See Engraving, front page.)

Sir,—I again request the pleasure to acquaint you of another machine, which, I believe, will realize great and important discoveries in all connected with submarine affairs, that for ever has been hid in the bosom of old ocean, from mortal view and ken.

The picture of this machine, though a bad one, may be for good and all taken, as shown at fig. 6 of the one drawing; but, as it requires a general representation of the machine, to be understood how it can be faithfully applied or used, in surveying all that belongs to the waters under the earth, as precipices, ravines, caves, &c., as well as the beds of seas and rivers, I have, in the other drawing, been as faithful to this end, as, at least, will serve for its theoretical delineation.

Fig. 1 is a side elevation of the machine in section.

Fig. 2 is a representation at the centre of the machine, seen from its stern.

Fig. 3 is a bird's eye view of the inside of the machine, with the top geering removed.

Fig. 4 is a governor, by which the machine is made to rise or fall in the sea, and made to remain at any desired depth below the surface, steady and constant.

Fig. 5 is a weapon for scuttling an enemy's ship; for the machine is likewise empowered to display a new species of fight in naval engagements; though, it is evident that the outline of fig. 6 will not answer the arrangement of the machine in the other fig. 8, yet it may serve to explain all that might be gathered from a representation of its simple exterior, which resembles a flat-bottomed boat, tapering to a sharp stem and stern.

The body or shell of the machine, as shown in the three sections, is double, having a water-space, W S, W S, &c., running right round its sides and bottom. In the bottom of the machine, in figs. 1 and 2, there are three shells or two spaces; the outside or narrowest space, C C C C, is the condenser of the steam-engines. The steam-engines are shown in figs. 1 and 2, at the bow end of the machine; *e c*, *e c*, of both engines, are the cylinders, and *a c*, between the two cylinders, is an air-pump, by which the furnaces of the steam-boiler, and the hands employed about the machine, are supplied with air. In fig. 1, S B, is the steam-boiler; F is the furnace; *f f f f*, are the flues; F P is the funnel-pipe, passing from the top of the flues to outside the boiler, and down, through the sides of the machine, at the bottom at the vent-holes, *v v*; S B and F P and *v v*, are the same in figs. 1, 2, and 3.

In fig. 1, S R is the stoker's room before the boiler; C A is the coal apartment; A L is an air-lock, into which the men enter to pass np to D A; D A, rooms where air at the common density is heated, and where the hands refresh themselves, after being, for a time, exposed outside the machine or otherwise, to excessive pressures of air, according to the depth they are under water. In fig. 3, L is the landing-floor, from which the men go out of, and come into the machine by the well, W; P is a passage from the landing, L, running to the engine-room by the boiler on each side, as at F P, in fig. 2.

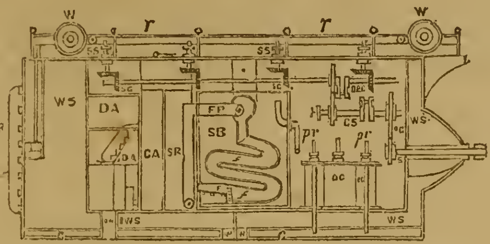
The air-cylinder, *a c*, fig. 3, draws the air from the surface of the water, down through pipes of malleable iron, such as A P; B J is a ball-joint, showing the manner the pipes should be coupled together; there is a leathern ring for a packing between the ball and socket, by which the joint is made perfectly water tight; *a p j* is the joining of the pipes to the machine; *a p*, in fig, 3, is the air-passages from *a p j* to the air-cylinder. P, in fig. 3, is the locomotive propeller of the screw species; it derives motion from the crank shaft, C S, fig. 1, by the wheels, P G, and shaft, S; *p p p p* of fig. 3 and fig. 1, are the force-pumps or air-pumps of the steam-engine; the steam is condensed by surface-condensation in the space, *c c c c*, and is drawn off by *p p p p*, or by three of them at least, and is forced by them back again into the boiler; the other pump, *p*, is required to compress the air into a small receiver, close by the landing, L, from which the men are supplied who descend below the machine; *p r*, *p r*, *p r*, of fig. 1, are the piston-rods of the engines and air-cylinder; *a c c*, fig. 1, is the air-cylinder crank, which gives motion to its piston. There is a shaft driven off the crank-shaft, C S, which runs along the top of the machine, as S G, S G, S G, S G, which gives motion to a number of vertical-spindles, *s s*, *s s*, *s s*, *s s*, and *s s* of fig. 2.

The instrument, fig. 5, is placed on the top of the spindles, *s s*, *s s*, &c., when the machine is to be engaged in battle; *c*, is the cutting, and *s*, the socket end of the instrument; *r r*, *r r*, is a railing round the top of the machine, and W W are two windlasses on fig. 1; R is the rudder of the machine.

Supposing the machine is to be employed for useful and quiet purposes, and is floating high out of the water on the surface, with the air-pipes coiled round into

small compass by the machine, or stretched on the water like a heavy cable (they being the same specific gravity of the water, nearly), a capillary funnel of a light temporary make, and of several pieces, is set on the top of the machine to give draught to the furnaces of the boiler, there being a suitable communication at c, between the top of the flues of the boiler, and the step of the funnel. Immediately on the steam being got up, the engines are put in motion, and the air-cylinder, *a c*, is re-

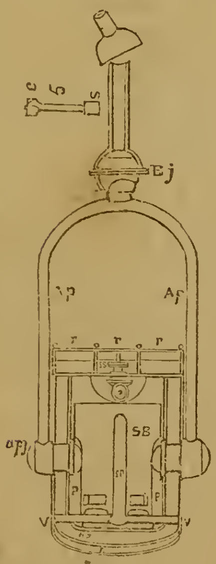
Fig. 1.



ceiving and discharging air from the air-pipes into the machine. This air has only one exit from the machine, which is through the furnaces of the boiler, down through the funnel-pipe, out at the vent-holes, *v v*, into the water.

Let the passage between the funnel on deck and the top of the flues be closed, the

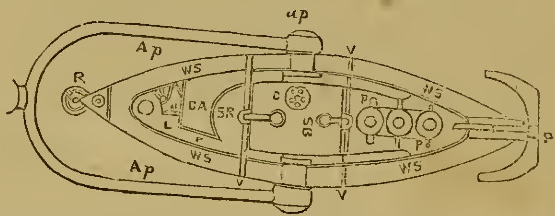
Fig. 2.



funnel removed, and all hands about the machine have taken their posts on the top and inside of the machine, the air will now be slightly compressed in every part of the machine, according as the machine is afloat higher or lower in the water, except in the rooms, D A, D A, where the air is always at the density of the common atmosphere, they being connected to the air-passage, *a p*, and closed from the atmosphere of the machine, except by the lock, A L; the air which is now discharged into the machine, is passing through the furnaces and out of the funnel-pipe, at the vent-holes, *v v*. If now we wish to descend, and are desirous to take an easy passage downwards, for the purpose, say, of examining any object we come across, and to shoot horizontally from one object to another, the space, W S, which surrounds the interior of the machine being, in the mean time, as the machine is afloat, almost filled with air, is, by means of the governor at fig. 4, made to fill with water, till the machine be immersed in the sea; the air escapes from the space by a valve wrought by the governor, into the air-passage, *a p*. But we will examine the nature and action of the governor first:—W S, at fig. 4, is the water space which surrounds the machine; there is a pipe, *m*, which passes up to the top of the space, open at both ends, which is a communicating passage between the space and inside of the machine; over the end of this pipe there is shown a slide valve, *v*, which likewise covers the end of the passage, *n*, leading from the valve, *v*, to the air-passage, *a p*. The valve, *v*, is connected to the end of the lever, L, by the link, *l*; *f c* is the fixed centre of the lever, L, at *c*, by its rod passing through a stuffing-box in the end of the cylinder. There are two ports, one at top and bottom of the cylinder; *w p*, the top port, is a passage out to the sea; and *a p*, the under port, is a passage to the air-passage, *a p*.

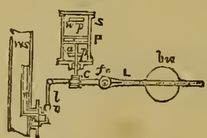
Now if the machine is to be sunk a fathom, or any depth, the weight, *b w*, on the lever, L, is placed towards the mark on the lever, which indicates the depth the machine is to be sunk to; the weight of the sea above the machine, or rather above the piston, P, in the cylinder, S, tends to depress the piston, it having only common atmosphere to resist the weight of the water on the under side; but now, if the weightiest end of the lever be heavier than the weight of the sea on the piston, the end of the lever to which the valve, *v*, is attached, will rise, and the valve, *v*, with it; but the moment the valve rises the smallest, it communicates the top of the water-space, W S, through the pipe, *m*, with the air-passage, *a p*, through the port, *n*; the air on top of the water-space, W S, will make instant way down through the pipe, *m*, through the valve, *v*, into the port, *n*, and away into air-passage, *a p*. This escape of air will instantly be supplied by the sea rushing

Fig. 3.



up into the water-space at the bottom of the machine, by the water-way, *w a*, which will instantly make the machine to descend. Now, as the machine sinks, there will be a continual increasing weight of water coming in upon the top of the piston, F, which will at length balance the weighted end of the lever to which the piston is attached, and the moment it does balance the weight, the lever will be restored to its original level, and the valve, *v*, to its former place. But, perhaps, ere the valve shuts off the communication between the pipes, *m* and *n*, and while the machine was but yet sinking to its depth, there too much water might have entered into the space, W S, which would, of course, cause the machine to be still going down; if so, and if it sinks but an inch below the depth corresponding to the place of the weight on the level, L, then will the pressure of the sea on the piston, P, be an overbalance for the weight, and the end of the lever to which the valve, *v*, is attached, will be depressed, causing the valve now to sink below the mouth of the pipe, *m*. The air now which is in the machine, having thus a free passage to the space, W S, by the pipe, *m*, and it being as much denser than the air in the top of the space, as the depth of water from the surface of the sea to the vent-holes, *v v*, is greater than the depth of water from the surface of the sea to the surface of the water in the space, W S, it will rush up the pipe, *m*, to the top of the space, W S, and will force the surplus water out again by the water-way, *w w*, at the bottom of the machine; therefore must the machine necessarily come to rest at any desired depth below the water; nor can it remain a moment steady, but at that depth which

Fig. 4.



corresponds to the distance the weight, *b w*, is from the centre of the lever, L. The propelling or horizontal locomotive powers of the machine, together with the means of steering through the deep, will be seen to be such as is usually employed. The machine is by the screw dragged, not pushed through the water, though, as a matter of no consequence which way it be employed, except that the rudder will be handier wrought as it is.

As this machine is cut out for two distinct purposes, I will endeavour to show how it can be employed to the destruction of a wooden armament, or the defence of a coast or river.

First. The machine is built of malleable iron, with two decks, about the common distance apart. The scuttling-spindles, *s s*, *s s*, *s s*, *s s*, to the amount of twenty or thirty, run flush with the topmost deck. Boring tools, such as is shown

by fig. 5, of various lengths, are in plenty between decks; they are adapted to cut either wood or copper.

Let the machine be attached to the bottom of a stout well-manned vessel, with a short length of air-pipes, which passes through the bottom of the vessel from which the machine receives her air; and suppose that now the machine is dragging along with the air-vessel the number of ships to be brought to the engagement, and is swimming high out of the water like another boat; when it has come within common range of the enemy, it sinks below the surface of the water, slow in its speed, and is secured to the bottom of its own ship by a simple fastening. This done, the machine again moves on, now dragging her consort as before, but guided in her course by the steering of the ship above, till they have manoeuvred their course close to the enemy. The machine now lets go the windlass-grappling, which holds her to her own ship, and, spouting from under her hidings, gets under the bottom of the enemy's vessel. By the two windlasses, W W, and a simple grappling, the machine is brought to a steady bearing below the enemy; instantly the drills are clapped on the tops of the vertical spindles, and as each man gets ready, the spindles are thrown in geer. There is a back balance-weight now falls between decks, which raises the socket in which the drill is placed, and keeps the drill up to the bottom of the ship as it bores. Twenty or thirty of such tools would make more peace and quietness among the enemy in two minutes, than three hours' broadsiding could ever do.

Your opinion of all this may justly be very different; but if it be not altogether opposite to my own, perhaps you will favour me again through the "Mechanic and Chemist."

In figs. 1 and 3, the funnel-pipe, F P, is shown on the wrong side or end of the steam-boiler; it should be shown at the end next the steam-engines, but in the same manner of shape as it is represented.

I am, Sir,
Most respectfully yours,
MATTHEW SPROULE.

Why do fishes, when dead, float on the surface of the water with the belly uppermost? Because the body, being no longer balanced by the fins of the belly, the broad muscular back preponderates by its own gravity, and turns the belly uppermost; as lighter, from its being a cavity, and because it contains the swimming bladders, which continue to render it buoyant.—*White's Natural History.*

RAILWAY ACCIDENTS.

It is at the request of several of our correspondents that we return to this important subject. With regard to mechanical precautions and improvements, the best advice we can give to those of our readers who have devised plans for the greater security of railway travelling, and who are not disposed to pay the heavy penalty inflicted on genius by the patent laws, is to publish their inventions without reserve; for, by so doing, they will, at all events, secure to themselve the credit of their inventions, and stand a better chance of deriving pecuniary benefit from them, than they would do by making private communications to strangers, and, we are sorry to say, sometimes even to those who assume the title of *friends.* It often happens, that great men will not afford sufficient time for a careful examination of such projects; and little men are too often either incapable of appreciating the value of new ideas, or too eager for their own aggrandisement, to neglect any opportunity of advancement, even though it be at the expense of their honour. We make this distinction between great and little men because we consider no man worthy of being called great, if his talent, learning, or station, be not adorned with the still nobler qualities of probity and honour.

Although most of the recent railway accidents have been caused by gross neglect and mismanagement, and their recurrence might, in future, be prevented by the enforcement of proper regulations, we do not wish to discourage attempts at improvements in the construction of the machinery; but it must be allowed that, for the security of travellers, as well as for the credit of railway directions generally (we do not allude to any particular Company), the most urgent and indispensable reform, is the appointment of properly qualified persons in sufficient numbers to conduct the trains, and attend to every circumstance that requires especial precaution. This the railway directors know as well and better than the public; but they fear that such measures, fully carried out, might operate unfavourably on the balance sheet; and it is not surprising that a commercial company should esteem the amount of profit a consideration of paramount importance. The public require an efficient administration of every branch of railway service; and it is in their power to obtain it upon the same principle as biting a bull-dog's tail, to make him let go his hold—viz., by the

infliction of heavy deodands, and encouraging other modes of travelling till it is granted.

This law of deodand is of very ancient origin: it appears, that in the olden time,—deservedly called the age of darkness—all things or animals which caused the death of a human being, were forfeited *Deo dandum*, for a gift to God. The real object, however, was clearly to extort money; for though it was pretended that the deodand was to atone for the deceased being hurried out of the world without the prescribed religious ceremonies, it appears that things became deodand, when the sufferer survived a year after the accident. Lawyers of the present day are not so mercinary; there is not one to be found, higher than the Lord Chancellor, or lower than the petty-foggers that crawl about the police offices of London, that would be influenced by so mean a sentiment. The following extract from a correspondent of a morning paper, will be found interesting, especially to those who are called upon to act as jurymen at coroners' inquests:—

"Deodand.—*(Deo dandum)*.—Is a thing given as it were to God, to appease his wrath, where a person comes to a violent death by mischance, and is forfeited to the King or grantee of the Crown. If to the King, his almoner disposes of it by sale, and the money arising therefrom he distributes to the poor. If forfeited to the Lord of the Liberty, it ought to be distributed in the same way.—3 *Inst.* 57, &c. &c. The original of Deodands is said to come from the notion of Purgatory; for when a person came to a sudden or untimely deatb, without having time to be *shrieved* by a priest, and to have extreme unction administered to him, the thing which had been the occasion of death became a deodand, that is, was given to the church to be distributed in charity, and to pray for the soul of such deceased person out of purgatory.—1 *Litt.* 443. There are several examples of forfeitures in cases of deodands, as if a man is driving a cart, so as the wheel runs over him, and presseth to death; the cart-wheel, cart, and horses, are forfeited to the Lord of the Liberty. For *omnia quæ movent ad mortem sunt Deodanda.—Bracton.* But it has been observed, that at the present day, if a man be killed by the wheel of a cart, drawn by horses, the Jury find that only *deodand* which was the immediate cause of death, viz.—the wheel, which is then seized by the Lord of the Manor, and converted to his own use.—1 *Nelson*, 639.

"If a man riding over a river is thrown off his horse by the violence of the water, and drowned, his horse is not deodand, for the death was caused per *cursum aquæ*.—2 Co. 483. Where one under fourteen years of age falls from a cart-horse, &c., they are not deodands; but if a horse kicks and kills such a person, it is deodand. 5 *Inst.* 57. And if a person wounded by any accident, as of a cart or horse, and die within a year and a day after, that which occasioned death is deodand; so that if a horse strikes a man, and afterwards the owner sells the horse, and the party striken dies of the injury, the horse, notwithstanding the sale, shall be forfeited as deodand.—*Plowd.* 260. If one falls out of a vessel, in salt water, the vessel is not deodand, as accidents at sea are frequent; but if one fall out of a vessel in fresh water, it is said to be otherwise.—*Wood's Inst.* 212. Things fixed to the freehold, as a bell hanging in a steeple, a wheel, or mill, &c., unless severed from the freehold, cannot be deodand.—2 *Inst.* 281. And there is no forfeiture of deodand till the matter is found of record by the Jury that finds the death, who ought also to find and appraise the deodand.—1 *Inst.* 144. After the Coroner's inquisition the Sheriff is answerable for the value, where the deodand belongs to the King, and he may levy the same on the town, &c.—1 *Hawkins.* A deodand is, in law, a forfeiture of anything or animal which occasions the death of a human being by mischance. Where the death is purely accidental, and no blame is attached to any person, the Coroner's Jury find a deodand of one shilling, or the like."

PREVENTION OF RAILWAY ACCIDENTS.

To the Editor of the Mechanic and Chemist.

Sir,—The writer has a plan to prevent the serious accidents which are constantly occurring upon railways. It is simple and effective; and, having a great regard for human life, would give it up to the public if they were poor; but, that part of the community being rather opulent, he, in justice to himself, thinks he should be rewarded for the trouble he has taken. The patent laws being so oppressive and expensive, he is not desirous of interfering with them. If any of the Railway Companies would adopt this improvement, which will be effective and expensive, it would prove advantageous to them, and secure the lives and limbs of both the passengers and the Company's servants employed upon the trains. As the writer is

a constant reader of the "Mechanic and Chemist," those who wish to embrace this opportunity, may signify their intentions through the medium of your pnblication, where it will meet his eye.

Yours, &c.

X. Y. Z.

[The information we gather from this communication is, that the patent laws form one serious impediment to mechanical improvements.—Ed.]

(From a correspondent of the "Railway Times.")

Suppose a luggage or passenger-train to meet with an accident by a carriage breaking down or getting off the rail, a stoppage of course ensues. Now, trains are so timed, as to follow twenty minutes or half-an-hour after each other, and I may be told, that the large lights at the *tail end* can be easily seen. This I deny; for these lights being so near the ground, they are very difficult to be observed from a distance, and where there is a curve or bridge, they cannot be *seen at all;* and, consequently, the driver of the next train gets so close, that before he has time to let off sufficient steam and put on the crew, his engine runs into the *stopped train.* If each driver, and also the person employed at the tail end of the train (whom I will call the guard), were furnished with three sky-rockets each, and on any stoppage taking place *from accident*, likely to detain the train, the driver of such train were immediately to let off a rocket, the drivers following would see these sudden lights in the air two or three miles off, and thereby have full time to come up quietly. In this way, too, a communication might be established along the line, or, at least. from station to station. It is well known that rockets can be made to produce various colours in their combustion—say red, white, or blue—and the drivers might be instructed to know, that a certain colour would indicate upon which rail the stoppage is.

SALT.

(Concluded from page 277.)

Salt was supposed by the ancients to be so detrimental to vegetation, that when a field was condemned to sterility, it was customary to sow it with salt. Modern agriculturists, however, consider it as a useful manure. The proportion of half-a-peck of salt to an area of soil equal to forty yards long by one broad, has been found to succeed. About twenty years since, Lord R. Manners applied salt in solution to the irrigation of herbage: one ounce of salt to a gallon of water was used with success; a stronger solution of two ounces to a gallon of water, was found to destroy the blades of grass; but, in the next season, an abundant crop of herbage came up. Dr. Holland recommends from eight to sixteen bushels of salt per acre. A mixture of salt and soot is a good manure; it is, indeed, the best compound, as a manure, into which salt enters as an ingredient. Corn is steeped in salt to prevent *smut.* In orchards, irrigation with a salt solution is recommended; and, strewed on the surface of the soil, it destroys slugs and snails in gardens; but it will also destroy vegetation, if dropped on the leaves of young growing plants. The use of salt as a manure is not confined to Europe: all the land on the coast is regularly treated with sea-water in China and Hindostan. It is to ferruginous sandy soil that salt is understood to be particularly adapted as a manure. Wood steeped in a solution of salt, so as to be thoroughly impregnated with it, is very difficult of combustion; and in Persia, it is supposed to prevent timber from the attacks of worms, for which purpose it is used in that country. Bruce informs us, that in Abyssinia it is used as money; and it is very probable that the pillars of fossil glass, in which the Abyssinians are said by Herodotus to have enclosed the bodies of their relations, were nothing but masses of rock salt, which is very common in that part of Africa. In manufactures, the uses of salt are very various. It enters into the composition of sal ammoniac, of glass, of oxymuriate of lime, of corrosive sublimate, of Glauber's and Epsom salts, and of the painter's patent yellow; and if used in bleaching, in glazing earthenware, in assaying metals, in case-hardening steel, and in rendering iron malleable.

C. Davidson.

REVIEW.

The Pictorial Rhyming Lessons; The Alphabet Geometrically and Numerically arranged; Visible Exercises in Numbers. By F. Wilby, Master of the Pestalozzian Academy, Worship Square, London: Grombridge.

A very excellent set of cards, calculated to arrest the attention and call into exer. cise the thinking faculties of children. We think them likely to be highly beneficial to the child, as well as a pleasing auxiliary to the tutor.

MISCELLANEA.

The Great Liverpool Steamer.—This splendid vessel started from Falmouth on Wednesday, the 3rd instant, at thirty minutes past four P.M., on her second voyage to Malta and Alexandria. She takes out a heavy East India mail, and sixty-five passengers. Amongst other matters of interest connected with the departure of this vessel it may be mentioned, that she has on board a quantity of fruit trees, salmon, turbot, &c. &c., as a present from the Directors of the Peninsular and Oriental Steam Navigation Company, to his Highness Mehemet Ali, probably the first instance on record of the produce of the Tweed and Severn being sent to the shores of the Pharoahs, a distance of three thousand miles,

School for Railway Engine-drivers.—If any proof were wanting of the general ignorance of train conductors of the nature and responsibilities of their duties, the recent evidence taken before Coroners' Juries would afford an abundant supply. This being the fact, we are glad to know that a vigorous effort has at length been made, by the Directors of the Polytechnic Institution, to remedy this serious and growing evil. They have opened an institution at their establishment, under the management of a well-known professor and experienced engine-driver, where pupils may be properly qualified for their responsible duties. The plan adopted is to give a series of lectures, in which the nature and property of steam in its connexion with the steam-engine, as well as the whole of the construction of locomotive machines, are fully explained; and this is done with the aid of a most complete and extensive apparatus, consisting of working and sectional models, and other necessary adjuncts. We sincerely hope the railway companies will look to this matter, so deeply affecting their own interests and the safety of the travelling public.

Electrotype.—At a meeting of the Graphic Society held on Wednesday last, several impressions were exhibited of prints taken from electrotype plates, both of line and mezzotint, which defied even the most experienced judges to say which was the original or which the copy. There will be no necessity hereafter to print from worn-out plates, or to re-engrave them. A plate fresh from the engraver's hands, can now be multiplied if necessary, into a series of coppers—steel will no longer be of use. This will lower, not their value, but their price, and bring a new class of purchasers into the market.

The nearest of the fixed stars yet observed is supposed, on good grounds, to be not less than forty-one billions and forty thousands of miles distant.

Knives are said to have been first made in England, in 1568, by one Mathew, on Fleet Bridge, London.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, December 23, Sheridan Knowles, Esq., on the Drama. At half-past eight.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 23, Quarterly Meeting. At half-past eight.

Pestalozzian Academy, Worship Square.—Tuesday, December 22, Major Beniowski, on Mnemonics.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 21, Discussion. At half-past eight precisely.

QUERIES.

I have been in the habit of using a voltaic battery on Professor Daniel's principle, with a bladder to contain the zinc and salt and water; finding this very troublesome, I substituted for it the porous earthen pots, which are now so much in vogue; but my battery does not possess half the power that it did when bladder was used. Do the porous pots present a greater obstacle to the passage of the electric fluid than bladder? Perhaps of the number of your readers, some one may be able to answer that question.
W. H. W.

The best method for preparing an indellible ink, without the mordant, similar to that bearing the name of "Koud's." P. H. Y.

How may I try a sample of manganese by fire, so as to ascertain the quantity of oxygen gas it contains? 2. How to try a sample of the same with muriatic acid, stating the quantity of manganese and the quantity of acid for a sample? 3. Does a given quantity (say an ounce) of manganese give out the same quantity of oxygen gas by fire as an ounce of the same manganese gives chlorine gas with muriatic acid? if not, state the difference. A. S.

What the magnifying power of each of the glasses in the eye tube of a four-feet telescope ought to be to make the required magnifying power; and what the object-glass ought to magnify for the same? A. K. P.

TO CORRESPONDENTS.

C. J. K.—*There are four volumes, at 4s. 6d. each, up to Nov. 5, 1839; after which, to 4th of January, there would be thirteen Numbers.*

S. Walter.—*His plan of stopping a steam train suddenly, is impracticable. We refer him to an article on the subject in our last.*

T. S.—*Pictures in marble dust are executed by d signing the figures with a strong varnish, and laying the powder of the required colour upon it. When they become faded, there is no known method of restoring them.*

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THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 126 & 127, NEW SERIES. | SATURDAY, DEC. 26, 1840. (PRICE TWOPENCE.) | Nos. 247 & 248, OLD SERIES.

ROLLING LAMP.

FIG. 1.

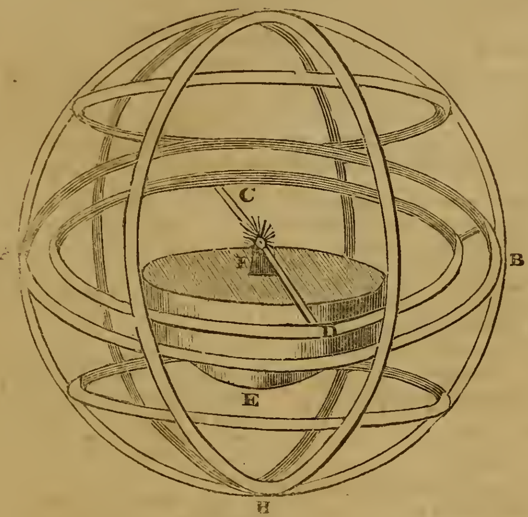
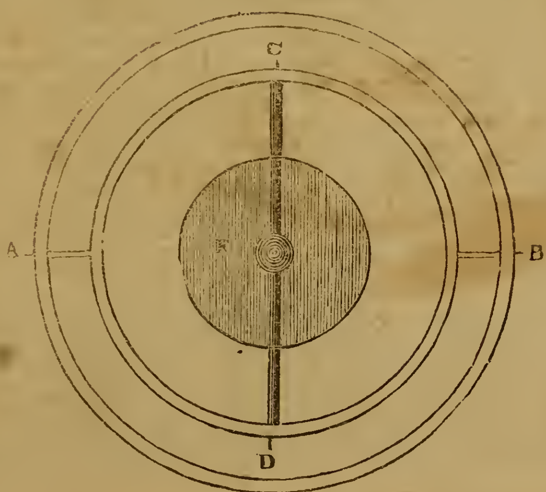


FIG. 2.



 City Press, 1, Long Lane: Doudney and Scrymgour.

ROLLING LAMP.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

Sir,—The following description of a rolling lamp will, I trust, be interesting to your readers, and the hint may be useful to those concerned in the manufacture of lamps. A C B H, fig. 1, is a hollow spherical frame or shell, which may be made of any pattern, provided it be perforated to allow the air to circulate, and the light to pass through. An internal circle is suspended, so as to move freely on the pivots, A B, and the lamp, F, is suspended in the centre, moving on the pivots, C D, at right angles to A B. The centre of gravity, E, is, in all positions of the frame, perpendicularly under the centre of the sphere; so that the whole apparatus may be rolled along the ground, or subjected to any other motion, without altering the upright position of lamp.

Fig. 2 shows the mode of suspension more clearly; and many useful applications of this principle in the simple form there exhibited, may be suggested by the ingenious. It is proper to state, that this lamp is not my own invention, neither is it new; but I believe it is not very generally known. Q. E. D.

SCIENCE WITHOUT MYSTERY.

No. II.

ON OPTICS AND THE PRESERVATION OF THE SIGHT.

In all ages it has been a reproach to natural philosophers, that rather than confess their ignorance of anything in nature, they have invented false or suppositious theories; and they have so interwoven truth with error, that a student of ordinary judgment and talent is unable to distinguish the one from the other. The nature of light, and the manner in which it acts to produce vision, has been a theme for the exercise of much ingenuity, and has called forth many fanciful creations from modern as well as ancient philosophers. Des Cartes indulged so much in speculations of this kind, that he has written whole volumes on various branches of science, entirely made up of unfounded propositions, the emanations of an unbridled imagination. This writer's theory of vision is, however, entitled to some notice, as the same opinion is entertained by Huygens and Euler; they suppose that there is a subtile elastic medium which penetrates all bodies and fills all space; and that vibrations excited in this fluid by the luminous body, are propagated thence to the eye, and produce the sensation of vision, in the same manner that the vibrations of the air, striking against the ear, produce the sensation of sound. Professor Wood remarks, that it is objected to this hypothesis, and the objection has never been answered, that the vibrations of an elastic fluid are propagated in every direction, and to every corner to which the fluid extends; on the supposition, therefore, that light is nothing more than the effect of the vibrations of such a fluid, there could be no shadow or darkness. If it be said that the fluid by means of which vision is excited, is different from all other elastic fluids, the effect is ascribed to a cause, the nature of which is unknown; and the hypothesis amounts to nothing more than a confession, that we are ignorant in what manner vision is produced. The theory of undulations, which is now held in so much esteem, is little more than this old theory, with some pretended improvements. According to the Newtonian hypothesis, light consists of very small particles of matter, which are constantly thrown off from luminous bodies, and which produce the sensation of vision by actual impact upon the proper organ. In favour of this hypothesis it is observed, that the motion of light is conformable to the laws which regulate the motions of small bodies under the same circumstances. Thus, where it meets with no impediment, it moves uniformly forward in right lines; and, in its incidence upon reflecting surfaces, the direction of its motion is changed as it would be, did it consist of small particles of matter. But however plausible this hypothesis may appear, it must be recollected that it is only suppositious, and, therefore, inadmissible as the foundation of any theory. In rejecting all speculative hypotheses, we do not contract the limits of pure optical science; for those properties of light which are discovered by experiment, are sufficient to explain all the principal phenomena which are the object of optics. Leaving, therefore, in doubt those mysteries of nature, which philosophy has not yet unveiled, we will proceed upon the sure ground of known and indisputable facts, to explain the laws of reflection and refraction, which are the principles upon which the whole doctrine of optics is founded.

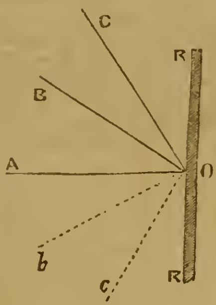
A ray of light, while it continues in the same uniform medium, proceeds in a straight line; for objects cannot be seen through bent tubes; and the shadows of

bodies are terminated by straight lines. Also the conclusions, drawn from calculations made on this supposition, are found by experiment to be true.

When a ray of light, incident upon any surface, is turned back into the medium in which it was moving, it is said to be *reflected*. Bodies which light cannot penetrate, are called *opaque*, and those through which it passes are called *transparent*.

In meeting an opaque body, it happens to rays of light, as it would happen to an impinging elastic body; that is to say, it

FIG. 1.



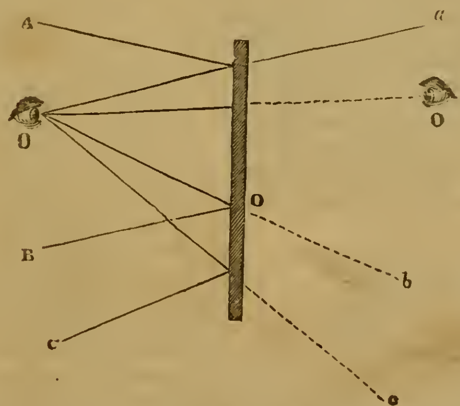
rebounds, or is reflected back at an angle equal to that which it formed in meeting the obstacle. This general law is expressed by saying, that *the angle of incidence is equal to the angle of reflection.*

Let B O be a ray of light incident on the reflecting surface, R R, at O; it will be reflected in the direction O *b*, making the angle B O A, equal to the angle A O *b*, A O being perpendicular to R R. The ray, C O, which arrives more obliquely at the same point, O, will be reflected in the direction O *c*, making the angle, C O A, equal to the angle A O *c*. If A O represent a ray falling perpendicularly upon O, it will be reflected back upon itself in the direction O A. It is one of the incomprehensible properties of light, that rays will pass each other in every direction, without any perceptible impediment to each other; for rays proceed from every visible point in the universe to every other point, and, in their progress, pass freely through torrents of light issuing, in all directions, from different suns, and different systems.

Opaque bodies are either bright or dead, according as they reflect rays of light more or less perfectly. In very brilliant bodies, the reflection is so perfect, that we cannot see the bodies themselves, but only the bodies which send them their rays; thus, in highly-polished mirrors, the reflecting surface becomes invisible, and we only see the surrounding objects as if pourtrayed upon it.

The eye, fig. 2, which looks at a mir-

FIG. 2.



ror, sees only the images, *a b c*, of the bodies, A B C, placed at different angles, and they are seen beyond the mirror, in the directions of their reflected rays, and at the apparent distance behind the mirror, equal to the real distance of the objects from their points of incidence; but *a* is seen at the right of *b*, and *c* at the left; which is the reverse of the real position of the objects.

If all bodies were perfectly smooth and bright, we should see only the reflections of the luminous body, which is the first source of light; but as most bodies, owing to the roughness and unevenness of their surfaces, disperse or arrest the rays which

they receive, we perceive their own forms, colours, and appearances.

It must be observed, that the angle contained between the incident ray and the perpendicular to the reflecting surface at the point of incidence, is called the *angle of incidence*. B O A, fig. 1, is the angle of incidence of the ray, B O.

The angle contained between the reflected ray and the perpendicular to the reflecting surface at the point of incidence, is called the *angle of reflection*. A O *b* is the angle of reflection of the ray B O.

The angle contained between the incident and the reflected ray, is called the *angle of deviation*. B O *b* is the angle of deviation of the ray, B O.

Q. E. D.

(To be continued.)

ACCIDENTS ON RAILWAYS.

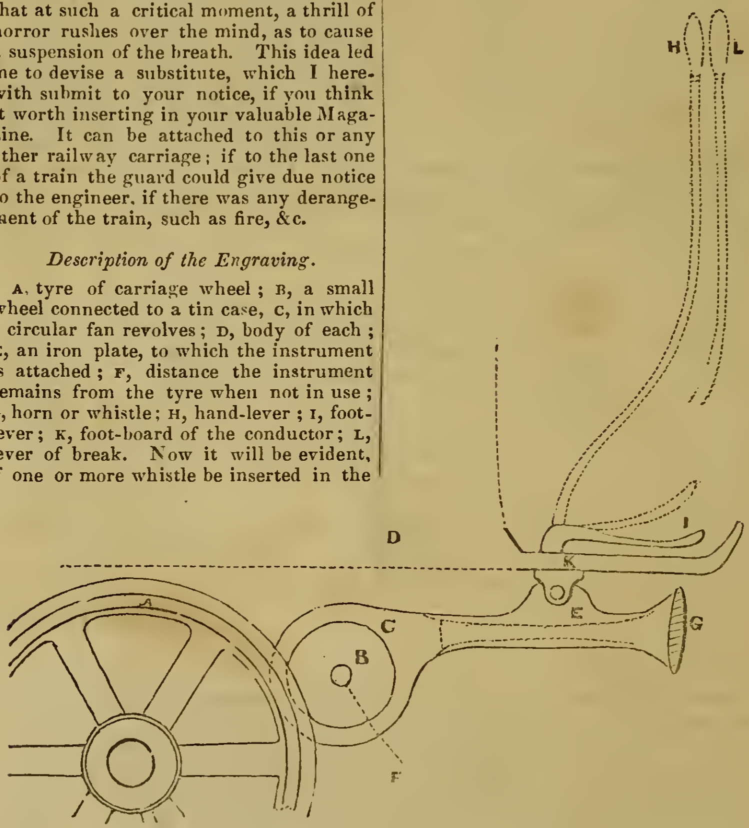
To the Editor of the Mechanic and Chemist.

SIR,—One out of the numerous accidents that of late have occurred, attracted my attention—viz.., that on the London and Blackwall Railway. On the coroner's inquest, it was there stated by one of the conductors, that he was unable to blow his horn at that moment: now I conceive, that at such a critical moment, a thrill of horror rushes over the mind, as to cause a suspension of the breath. This idea led me to devise a substitute, which I herewith submit to your notice, if you think it worth inserting in your valuable Magazine. It can be attached to this or any other railway carriage; if to the last one of a train the guard could give due notice to the engineer, if there was any derangement of the train, such as fire, &c.

Description of the Engraving.

A, tyre of carriage wheel; B, a small wheel connected to a tin case, C, in which a circular fan revolves; D, body of each; E, an iron plate, to which the instrument is attached; F, distance the instrument remains from the tyre when not in use; G, horn or whistle; H, hand-lever; I, foot-lever; K, foot-board of the conductor; L, lever of break. Now it will be evident, if one or more whistle be inserted in the tube or horn, or a large poppet, and the circular fan raised, so as the wheel, B, touch the tyre, an instantaneous blast will be produced, which will be heard at a very considerable distance; and, I apprehend, this will entirely obviate the like occurrence again.

E. G. HITCHINGS.



A VISIT TO A POT MANUFACTORY.

No. IV.

SOME articles are coloured in square or oblong patches; flower-pots are often coloured in this way. This effect is thus produced:—The articles are first fluted or chequered, or figures are made on it with the runner—an instrument previously mentioned. These fluted or figured parts are next covered with a band of slip; the article is then removed from the chuck, and placed to dry. When sufficiently dried, the article is placed upon the chuck again; the turner applies his cutting tool to the coloured part, and the tool, catching only the elevated parts, leaves the colour in all the depressions, thereby producing the effect above mentioned.

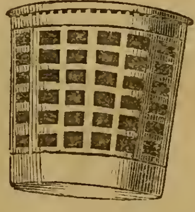
The slips used by the coloured-ware turner are black, white, red, drab, and a few others. White slip is the cuttings of the earthenware turner dissolved in water. Drab and red are made of different kinds of marl. Black is composed of burnt iron-stone, mixed with brown slip; brown slip is a compound of red marl and ironstone; blue slip is often used.

As the turning of lustre is the same, in many respects, as that of earthenware, we will only notice the colouring of the articles by the turner. Previous to lustre-ware being turned, the inside is made white by pouring in and out a quantity of white slip: a crust of slip adheres to the article. The articles are coloured on the outside by blowing from the blowing-bottle (previously mentioned) bands of slip round them. A band is made sometimes round articles of lustreware with different colours, so as to resemble marble; this is called porphyryware, and is thus manufactured:—The article is turned and smoothed, and a band, varying in size from an inch to three or four inches, according to the size of the article, is made round it with white slip. This band is covered by the lathe-treader with a mixture of little bits of blue, yellow, drab, brown, and white clay. These little bits of clay are obtained by hardening large pieces of the substance, pounding them, and passing the pounded clay through sieves of different degrees of fineness, to separate the large lumps and the dust. The article is then set away to dry. When it has become hard enough, the part upon which the mixture is put is dipped in water, and the article being placed upon the chuck again, the workman applies a flat tool, with a gentle pressure, to the porphried part; by this means it is made smooth and level with the rest of the article. It is again placed to dry, and is finally finished, by being smoothed and polished in the same way as earthenware. This kind of pottery, when well manufactured, looks very beautiful. Some articles have a band of white grotto-work round them, made with little bits of white clay.

The operations of the black-ware turner are similar to those of the turner of earthenware, except that black ware is polished with a hare's foot; earthenware, with a smooth flat-iron tool. The object of this is, black, when finely smoothed and polished, will not take the glaze. In the turning of lustre and coloured ware, those parts that have to be coloured—that is, covered with slip, are not previously polished.

We will now notice the operations of the chinaware-turner. China, while in the clay state, is very tender, and, therefore, requires to be operated upon with great care. A person who has not been used to turning china, when he comes to work in that sort of pottery, will break a great many pieces of ware during the first three or four days, if he be not very careful. China cups and basins, previous to being turned, are straightened by inserting into them a block made of plaster of Paris. The person who performs this operation is called the blocker. The chinaware turner's tools differ from the other turners' tools; for, in addition to the end being turned up about half-an-inch, the edge of the tool is turned up about one-eighth of an inch. The tops of articles of china are not rounded in the same way as those of earthenware. After the article is turned, it is cut off square at the top, and, another sort of chuck being screwed on the lathe, the article is put on it, and the top rounded with a turning tool. Chinaware is not polished. The

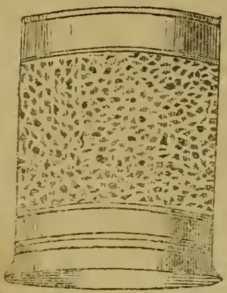
FIG. 1.



turner has nothing to do with the scolloping of articles of china. The scollops are made with a knife, by a person (generally a woman) called the scolloper. The clay

of which china-turned mugs are made, contains a little common clay. They are, therefore, not so tender as cups and basins. The turning of them is similar to that of earthenware mugs.

Fig. 2.



Cups and basins are sometimes made in a mould by the thrower. The article is first made in the same way as the common ones; it is then put into a mould and pressed close to it: it is then dried a little, after which the inside is polished; when sufficiently dried, it is taken out of the mould. These are called pressed-ware, and require turning only at the foot.

Fig. 1, a piece of fluted or checquered-coloured ware.

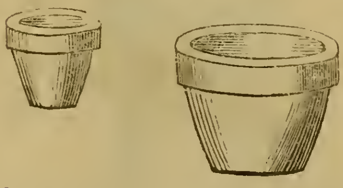
Fig. 2, porphyry ware.

Figs. 3, blocks used in straightening chinaware.

Fig. 3.

Fig. 4, moulds used by the thrower in making pressed ware.

Fig. 4.



In our next we will fix the handles, spouts, &c. to the articles—the operations of the handler.

PERKINS'S PATENT APPARATUS FOR TRANSMITTING HEAT BY CIRCULATING WATER.

One of the most important applications of this invention, is heating the water in a steam-boiler; the boiler is placed horizontally over the furnace, and the sides of the boiler and furnace are surrounded by a double casing of iron, containing water or some slow conductor of heat. Those parts of the boiler and casing which are in close proximity with the furnace and flue, are protected from the action of the fire by a lining of fire-clay or bricks. The boiler consists of a vessel in the form of a parallelogram, having a perpendicular elongation of one-fourth the length of the boiler, which I shall call the water-box. The boiler is strongly braced by ties in every part, and thus rendered secure against internal pressure. It is to be furnished with safety valves, water-guages, and the other usual appendages of steam-boilers, being, in these respects, similar to the boilers ordinarily employed.

In a marine steam-boiler of sufficient capacity to evaporate fifteen cubic feet of water per hour, a series of wrought-iron tubes are employed, one inch in external, and half-an-inch internal diameter. These tubes, which form the chief object of the patent, are denominated, by the inventer, "circulating or transmitting tubes;" their use is to convey or transmit the heat from the fire in the furnace to the water in the boiler, by means of the circulation of the water contained within them, which water is entirely separated from, and independent of, that to be evaporated in the boiler. To effect this object, a portion of the tubes is employed to abstract the heat from the fire, and is disposed in and about the furnace and flue in such manner as most fully to accomplish the desired end, while another portion of the tubes is placed within the vessel containing the fluid to be heated, and imparts to the fluid the heat previously acquired in the furnace. The tubes are sixteen in number, and are arranged horizontally and parallel to each other, at the distance of one inch apart. Near the bottom of the water-box they enter that part of the flue which is most distant from the fire, and after rising in a serpentine direction, they pass under the fire, and, returning from the fire-bars of the grate upon which the fire rests, then again returning, they pass over the fire at its hottest point, and, emerging from the furnace, enter the boiler a few inches below the water line; then passing through the horizontal portion of the

boiler, they bend and descend through the water-box, and join their other respective ends in the flue. They are joined to a cross pipe, called the feed-pipe, the use of which is to distribute the water equally in all the tubes, thus avoiding the trouble and delay of filling each tube separately. Except at their junction with the feed-pipe, the several tubes have no connexion or communication with each other, but each maintains a circulation throughout its entire length independently of the rest. The length of each tube is fifty feet, and the total length of all the tubes is about 800 feet, being equal to a superficial surface of about 200 square feet; of which one-fourth part is within the boiler, and the other three-fourths in the furnace and flue. The ends of the tubes are joined to each other by sockets, with right and left-hand screws, and the joints thus made, are capable of resisting the pressure which the tubes themselves will bear. The passage of the tubes through the boiler-plate is rendered tight and secure by means of flange nuts screwed upon the tubes, and closely embracing each side of the boiler-plate. There is a small force-pump for supplying any deficiency of water that may occur within the tubes from leakage, that being the only manner in which loss can ever take place, in consequence of the tubes being completely closed in all parts. The water in the tubes, when heated, undergoes considerable expansion, or increase in bulk. To prevent any undue pressure which such expansion would occasion within the tubes, a valve is applied, loaded at a pressure somewhat above that which is consequent upon the temperature at which the tubes are worked, but far below that which the tubes are previously proved to be capable of sustaining; no water, therefore, is ever permitted to escape from this valve, but that which is ejected by the increased pressure arising from the expansion before mentioned.

In cases where the boiler is allowed to cool periodically, the tubes are to be supplied with water by a self-acting apparatus. A cistern, the capacity of which is proportioned to the size of the apparatus, communicates with the safety valve, and also with a supply-valve, opening inwards towards the feed-pipe.

The apparatus having been filled with water when cold, the heat of the fire will expand the water within the tubes, and create a pressure sufficient to open the external valve, and allow the excess of water to flow out into the cistern. When the tubes have arrived at their maximum temperature, the water will undergo no farther expansion, and the external valve will close. No more water will then escape, unless the tubes are sufficiently over heated to open the valve by the internal pressure. When the apparatus is allowed to cool, the water will contract to its original bulk, and a vacancy or vacuum will take place within the tubes equal in extent to the amount of water previously ejected by expansion, added to that which may have escaped by leakage at the joints; which vacancy will be immediately filled by water from the cistern, through the passage of the internal valve and the feed-pipe. The return of the water to the cistern when under pressure, is prevented by the closing of the internal valve.

The circulation of hot water, which takes place in each of the foregoing applications of hot-water tubes, arises from a well-known principle, and is similar to that which takes place in the apparatus for warming buildings before alluded to, and which has been made the subject of a previous patent. That portion of water contained in the tubes which are exposed to the action of the fire, acquires an increase of temperature; and its specific gravity being thereby lessened, it ascends by its superior levity, while that portion which is employed to transmit the heat thus acquired, to the water or other fluid, acquires increased density, as it parts with its heat and descends, by its superior gravity, to take the place of the lighter or ascending current.

It is desirable in all cases so to arrange the tubes within the boiler, generator, or other vessel, as to cause the hot-water current to flow downwards through the surrounding fluid, and impart its excess of heat, as far as practicable, to the upper surface of the fluid. In vessels of great height and small lateral capacity, the hot-water current, by descending through water of constantly decreasing temperature, will part with the whole of its heat, and leave the bottom of such vessel at a temperature little higher than that of the water, by which the vessel is supplied. This entire transmission or transference of heat, however, cannot take place, except in those cases where the lower extremity of the vessel is constantly supplied with cold water, to make good the deficiency occasioned by evaporation at the surface; and, consequently, when the water or other fluid is intended to remain for a long time stationary or unchanged, so that the whole mass will become equally heated, little benefit can result from the

downward current. Another advantage attending such an arrangement is, that in steam-generators of small capacity, no priming or overflow of water will ever occur, however hot the tubes may be.

It is also desirable to reduce as low as possible the temperature of the smoke and heated air, before allowing it to enter the chimney, by causing it to pass in an opposite direction to that of the hot-water current; so that, after leaving the fire, it may at first come in contact with the highly-heated tubes, and, lastly, with the colder tubes near the bottom of the apparatus. It is by due attention to this facility which this apparatus affords of reducing the temperature, both of the descending hot-water current, and the smoke and heated air to a point much below that of the steam, or of the upper part of the water or fluid, that one of its advantages is realized.

SHORE'S PATENT PROCESS OF PRESERVING AND COVERING IRON AND OTHER METALS.

(Abstract of Specification.)

My invention relates to a mode of obtaining or applying a permanent covering of copper or of nickel, by means of galvanic batteries, on articles manufactured of wrought or cast iron, tin, lead, and copper, and of alloys of such metals—such covering acting as a preservative to some of those metals and alloys of metals, and, in other cases, as a superior surface. And, in order to give the best information in my power, I will proceed to describe the means pursued by me in carrying out the invention; first remarking, that I am aware that the employment of the galvanic battery, to deposit copper on to a metallic surface, in order to obtain copies of coins, medals, and engraved designs, has been practised by many persons: and I have mentioned such process, in order to state that I make no claim thereto; my object being to obtain a permanent covering of copper or of nickel on to manufactured articles of the metals and alloys of metals herein mentioned, in order that such covering may act as a preservative external surface to such of the metals as require it, and principally as a superior surface in other cases, when the commoner or baser metal, tin, lead, or copper, forms the receiver of the permanent covering. The mode of depositing copper by means of the galvanic battery, when employed for obtaining copies of medals, coins, or engraved surfaces, being now well understood, it will not be necessary to enter into a particular description thereof in this my specification, farther than will enable a manufacturer readily to apply such process in carrying out my invention, in order to obtain a permanent covering on articles manufactured from the metals or alloys of metals above mentioned. I take an open vessel of a size depending on the article or articles to be operated on at one time; such vessel I prefer to be of wood or of earthenware, and I divide this vessel into two compartments, by a partition of unglazed earthenware or other porous substance; into one of the compartments I put pure water slightly acidulated, by preference with sulphuric acid or other material usually employed to obtain galvanic action, as is well understood; and into the other compartment I put a solution of a salt of copper, by preference sulphate of copper or nitrate of nickel, whichever is to be used as the covering metal. And I find in practice, that solutions of the metals act best when they are kept up to a neutral strength. Into the first compartment I immerse a piece of metallic zinc, or other suitable metal easily acted on by the solution, as is well understood; and to such piece of metal there is affixed a wire, by preference, of copper; this wire is bent over the partition, so as to enter into the solution in the second compartment of the vessel; and the manufactured article to be covered, is then to be placed in the second compartment, and the wire caused to be kept in constant contact therewith, taking care that the article under process is moved from time to time, to prevent any part or parts being left uncovered.

And it is important to observe, that the manufactured articles to be coated are well cleansed, in order that the action of the galvanic process thereon, may produce a perfect deposit or coating to the surfaces of the articles under operation; and for this purpose I prefer to employ heat, where the metal to be covered will allow of being raised to a low red heat, though the other known means of obtaining clean surfaces to such, and the other metals and alloys of metals herein mentioned, may be employed. When I employ heat, I prefer to place the metal articles into a crucible, covering them with sand, charcoal, black-lead, or other suitable powdered substance, and then raising the crucible and its contents to a low red heat in an open furnace, and then permitting the same to cool; when, on the manufactured metal articles being removed, they will be found in a good condition for

the process; the workman having first removed any sand or other substance therefrom, which may be found to adhere. It should be stated, that the solutions employed may be either hot or cold. The time which articles are to be kept under operation, depends on the extent or thickness of covering it is desired to be obtained; the longer the articles are under operation, the thicker the covering. In covering large articles, it will be found convenient to do each separately; but in covering small articles, such as iron nails, then I employ an open frame or basket of wire in connexion with the wire, affixed to the piece of metal in the first compartment of the vessel, such frame or basket allowing the small articles to be readily kept separate, and turned, by shaking up or otherwise.

ANTISEPTIC PROPERTY OF ACETATE OF ALUMINA.

On Tuesday last the body of a man, named George Berry, who died in the Westminster Bridewell in 1838, of epilepsy, was opened at the Windmill Street Theatre of Anatomy, in presence of Mr. T. Duncombe, M. P., Mr. Wakley, M.P., and a great number of gentlemen belonging to the medical profession. Four days after the death of the individual, a fluid of an antiseptic character was injected into the body by one of the carotid arteries. The corpse was then bound round with bandages, placed in a coffin, and kept in a room of varied temperature until Tuesday last, without being meddled with. The body having been lifted out of the coffin, was stripped of its bandages; the flesh was wonderfully firm, especially so were the muscular portions—the thews and sinews; the viscera was likewise in a remarkably perfect state, though discoloured, being of a clay colour. No effluvia was emitted, if we except that of camphor, which was rendered more disagreeable by the action of the fire, in a large cast-iron stove, which was close to the body. Certificates of the period of death, of the injecting process, and so forth, contained in a bottle beside the deceased, were exhibited; so that there could be no doubt of the fact. The dissection was carried on with the utmost fairness, and the result, as far as we could judge, gave satisfaction. Many of the details, of course, were only fit for the pages of a medical journal, and are here necessarily passed over.

In order that the origin of this discovery may be the better understood, it is proper to state, that in the year 1835, the French Academy of Medicine appointed a commission, consisting of five of its most distinguished members, to institute an inquiry into the subject. In 1837, this commission made a definitive report, in which it is stated, that during the preceding two years M. Gannal had been incessantly occupied upon a series of experiments, with a view to ascertain the best mode of preserving animal substances, and that he had at length succeeded in discovering a fluid, by the antiseptic properties of which, the remains of deceased persons might, by the simple and delicate process of injection by one of the arteries, be preserved for a considerable length of time, without any material change of feature or discolouration of countenance. After detailing a variety of experiments observed by the commission, and all of which had been attended with complete success, they gave it as their unanimous opinion, that M. Gannal had rendered important service to science and humanity; and they farther recommended that their report should be forwarded to the Minister of Public Instruction, directing his attention to a discovery capable of being applied to so many useful purposes; and likewise to the Minister of Commerce and Public Works, as a means whereby the public health might be placed on a surer foundation. The importance of the subject, and the interest attached to it, induced us to enter fully into its details. In no country, it is believed, is more decent and rational respect paid to the observance of every ceremony which concerns the remains of a deceased relative or friend, than in England; seeing that in no country the feeling of tender regard to the memory of the departed is more affectionately cherished. And if this has hitherto been the characteristic of Englishmen, it will be acknowledged that it is especially so at the present moment, when, in consequence of the increased population of the country, and the consequent crowded condition of the receptacles till now appropriated to the dead, cemeteries are in progress of being built, not only in the environs of this great Metropolis, but of most of the large cities and towns of the United Kingdom. At such a moment, and under such circumstances, it can be little doubted that a determination on the part of the proprietor of the "Gannal process," to introduce into this country, with regard to interments, that recently-discovered process, by means of which, the remains of the deceased can be preserved for a considerable time without material change in appear-

ance, and without inconvenience or danger to the living, will meet with the same favourable reception in England which has attended its establishment in France. Encouragement to this step has been induced by the numerous instances of extreme distress occasioned to relatives and friends by the early appearances of decay; and from conviction that such distress will be greatly alleviated by means of the discovery. It is conceived, also, that where the place of sepulture is situated at a distance, or where the members of a family happen to be absent, it must be a source of great satisfaction to know, that a process is ready for application on the instant, and at a moderate expense, which will preserve the body for an unlimited period from incipient decay, without alteration in its appearance, or the presence of the slightest effluvia—which arrests putrescency and the liability to cause contagion—which occupies but a short space of time in the performance, and is unattended with any distressing exposure or disfigurement of the person—which may, when desirable, be performed in the presence of the nearest friends of the deceased, without giving pain to minds of the most delicate sensibility; and, by the application of which, the usual but very revolting mode of preserving the remains of the dead by embalming, will be superseded. The discovery is designated "the Gannal process," from the name of the eminent chemist and natural philosopher by whom it was first made in 1826, and who, after fourteen years of unwearied skill and labour, has at length succeeded in bringing it to perfection. Beside the body of George Berry, lay that of an infant, who died eighteen months ago; many specimens also in natural history, preserved by the process we have described, were shown, all of which were considered by the scientific persons present, to be remarkably well preserved. The fluid, for there was no secret about the matter, is the acetate of alumina.

CHARCOAL.

Charcoal is the impure carbon obtained by the decomposition of vegetable matter by heat, without free access of air. It is prepared for the common purposes of fuel in the following manner:—Small pieces of wood, about twelve inches in length, and about one or two inches in thickness, are laid alternately, two one way, then two across, leaving a channel of five or six inches in the centre. This is called the chimney to the kiln. The wood is previously prepared in logs of about two feet in length: the large pieces are split into two or four.

When the chimney has been carried to the height of two feet, it is closed in on all sides with the prepared logs, placing the largest next to the chimney. It is thus raised successively two feet at a time, until it has reached the height of eight or nine feet, making the diameter at the base about twelve or thirteen feet; it is then cased with sods or earth, about six inches in thickness, and the kiln set on fire, by throwing some lighted chips down the chimney.

The sods or earth are first laid towards the summit, with a thin coating; then thickened, and, finally, when the wood appears sufficiently lighted, by flames issuing from the aperture, the chimney is stopped by a large sod on the top.

Great care is now required, that the smoke should issue in a moderate degree, and, generally, through the coating of earth, by placing a small plastering of mud over such crevices when it may burn too fast, or making small holes in the coating when not burning sufficiently equal with the rest. To effect this, it must be constantly watched, day and night. It may be ascertained if burnt enough, by taking several pieces from the outer side at various parts, and breaking them in two, to see if the interior part of the log is burnt equally with the exterior. It should break easily.

For the preparation of the finer kinds of charcoal, fit for medicinal use, the following process is employed:—The wood to be charred is put into a large cast-iron cylinder, fixed in masonry over a grate. This cylinder terminates at one end in a curved pipe, and the other end is furnished with a door, which is accurately closed after the wood is introduced. A fire is next lighted in the grate, and the water, empyreumatic acid, and volatile parts of the wood, are driven off through the curved tube by the heat, which is increased until the contents of the cylinder become red hot. The fire is then withdrawn, the cylinder is allowed to cool, and a black, shining, pure charcoal is thus obtained.* Ivory and bone shavings, treated in the same manner, make the preparation termed *ivory black*.

For internal use, however, it is, per-

* This process was invented by Bishop Watson for the use of the gunpowder manufacturers, who require a very pure charcoal.—*Aikin's Chem. Dict.* Art.—*Carbon*.

haps, necessary to have wood charcoal still purer; and, to effect this, the process of M. Lowitz is to be preferred. The charcoal is to be reduced to fine powder, and put into a crucible (so as to fill it), on which a pierced cover must be luted. This vessel is then to be heated red hot, and kept so, as long as a blue flame appears to issue from the hole in the cover; and when this stops, it is to be taken from the fire, cooled in a dry place, and the charcoal instantly put into well-stopped bottles for use. Vide "Crell's Chem. Journal," vol. ii., page 270.

In whatever manner prepared, the purest charcoal contains, generally, about one-fiftieth of its weight of earths, salts, or metallic matters; its other constituents are, according to Dobereiner, 68.4 of carbon, with 1.5 of hydrogen, and a minute portion of oxygen. The salts and earthy matters can be separated by boiling the charcoal with diluted muriatic acid in excess; then washing the charcoal on a filter with boiling water, until the fluid passes free from acid, and throws down no precipitate with oxalate of ammonia. The powder is finally to be dried in a stove.

Pure charcoal is inodorous and insipid, black, shining, and brittle. It is a good conductor of electricity. Its specific gravity is about 3.5. When newly prepared, it absorbs air, gases, moisture from the atmosphere, and liquids, so as to increase its weight from ten to eighteen per cent., according to the kind of wood from which it is made. From the experiments of Allen and Pepys, charcoal from fir gained 13 per cent.; from box, 14; from beech, 16.3; from oak, 16.5; from mahogany, 18.

Although charcoal is insoluble in water and every other fluid, there is, nevertheless, a quack preparation for cleaning the teeth, sold under the name of "Concentrated Solution of Charcoal."

Charcoal is easily pulverized. When excluded from air, it is not affected by the highest degree of heat. When pure and well washed, so as to destroy all the earths and salts, it corrects the fetid odour of putrefying animal and vegetable substances, and destroys the odour, taste, and colour of some, particularly of mucilages and oil, and matters in which extractive properties abound. Thus, common vinegar becomes colourless when it is boiled in pure charcoal powder; water, which has become fetid at sea, is purified by filtering it through charcoal; that intended for long voyages may be preserved perfectly pure, by thoroughly charring the insides of the casks.

Charcoal has been given internally to correct the putrid eructations of some kinds of dyspepsia; but, in order that it may produce this effect, it should either be newly prepared, or such as has been preserved in well-stopped bottles. It is probable that it operates both by correcting the fetor, and absorbing the gas generated in the stomach, as well as checking the decomposition of the undigested aliment. Dr. Calcagno, an Italian physician, proposed to employ it instead of cinchona bark in intermittents; but this suggestion has not been supported by British practitioners. It has been applied advantageously, mixed up in powder, with boiled bread or linseed meal and water, as a poultice, to foul ulcers and gangrenous sores; and it is, undoubtedly, in combination with powdered catechu, kino, or rhatany root, the best tooth-powder known. It may be used, also, as a test for arsenic. Farther information may be obtained by consulting Dumas, Traité de Chimie, tome 1, p. 558; also Phil. Mag., vol. 3, where is an interesting paper by M. Mushet.

DESCRIPTION OF THE MINES OF SEMNITZ.

By six o'clock in the morning we were all astir, and, armed with a change of clothes for me, we sallied forth to the accountant's office, where we were to be furnished with mining dresses for the gentlemen, and our guides with lamps for our underground journey. Away we went, however, and ere we had taken a hundred steps we were in utter darkness. We were moving along a passage, not blasted, but hewn in the rock, dripping with moisture, and occasionally so low as to compel us to bend our heads to allow us to pass; while beneath our feet rushed a stream of water which had overflowed the channel prepared for it, and flooded the solitary plank upon which we walked. But this was of little consequence, for the large drops that exuded from the roof and sides of the gallery, soon placed us beyond the reach of annoyance from wet feet, by reducing us to one mass of moisture. When we arrived, heated and panting, at the bottom of the first hemisphere, the chief miner led the way through an exhausted gallery, which yawned dark, and cold, and silent, like the entrance to the world of graves. * * * To the right of this gallery opened another vast cavern, cumbered with large masses of rock, but of which we could see the whole extent. Hence we passed through another gallery similar to the first, except that it had been produced

by blasting. * * * There was, moreover, something awful in the reflection, that the subterranean passages which branched off right and left, and which were clearly seen amid the darkness, extended for upwards of fifty miles, each mine throughout the range being accessible from that last traversed. The very echoes which swept away, and died, at last, in low whisperings afar off, added to the feeling; while the chill produced by our soaked and clinging garments, warned us not to linger too long amid the clammy draughts in inaction, but to move on from point to point without delay. * * * Another set of ladders, as steep and as sticky as the last, admitted us to the second hemisphere. When we were fairly gathered together in this gloomy cavern, and our guides raised their lamps and moved them rapidly along the roof and sides of the chasm, it was beautiful to see the bright particles of silver flash back the light. Having now arrived at as great a depth as any lady had yet attempted, I had no inclination to stop short so soon in my undertaking, as the miners beneath us were employed in blasting the rock in every direction. Being desirous of witnessing this the grandest exhibition which it could afford, the miner once more led the way to the ladders, and we commenced our third descent: the only variation being produced by an intense feeling of heat, increasing as we got lower, and a suffocating smell of sulphur—the natural effects of the work which was going on, 200 explosions having taken place since sunrise. When we arrived at the bottom, the sensation was all but suffocating; the dense vapours seemed to fold themselves about our wet garments, and in a few seconds we were enveloped in steam, which produced intense perspiration, and a faint sickness that compelled us to disburthen ourselves of all the *wraps* by which we had sought protection against the damp above. * * * We spent upwards of an hour in strolling through this section of the mine, and during this hour we only encountered three miners, although nearly 300 were at the moment employed in that particular hemisphere—a fact which will give you a better idea of this subterranean wilderness, than any attempt to describe its extent. There was something almost infernal in the picture which presented itself, when we at length returned to the spot where the next blast was to take place. A vast chasm of dark rock was terminated by a wooden platform, on which stood the workmen, armed with heavy iron crow-bars, whose every blow against the living stone, gave back a sound like thunder. I ascended the platform, which was raised above six feet from the rock-cumbered floor of the gallery, in order to see the process of stopping the bore, and then I had a full view of the frightful scene presented by the vault. Above me, the rock had been rent to such a height, that the lamps of the guides failed to afford a glimpse of aught save pitchy darkness, losing itself in its own shadows; beside me toiled the group of miners, thin, sallow, scantily clothed, and scarcely human looking. Beneath me stretched away, far beyond my vision, the vapoury gallery, where the dense mists were writhing and curling in suffocating eddies; while immediately under the platform sat or stood each of our party as had been too idle or too prudent to ascend it. At length the bore was completed; we, of course, made our way before the insertion of the inflammable matter, to a large opening, situated behind an abrupt projection, where an exhausted gallery terminated, and where no mass of rock could reach us in its fall. There we remained for full three minutes in silence, listening to the quick panting of the workmen, ere the mighty rock, riven asunder by the agency and cupidity of man, yielded to a power against which, after centuries of existence, it yet lacked the power to contend, and, with gigantic throes, gave up the hidden treasure it had so long concealed. First comes an explosion, as though the whole artillery of an army burst on the ear at once; and the vast subterranean gives back an echo like the thunders of a crumbling world; while amid the din there is the crash of the mighty rocks which are torn asunder, and fall in headlong ruin on every side; each, as it descends, awaking its own echo, and adding to the uproar; then, as they settle in wild ruin, massed in fastastic shapes, and seeming almost to bar the passage which they fill, the wild shrill cry of the miners rises above them, and you learn that the work of destruction is accomplished.—*From Miss Pardoe's "City of the Magyar."*

ARCHIMEDES.

Archimedes was born at Syracuse, about B. C. 287. He was one of the first of the Greeks who cultivated the science of mechanics as referring to the action of forces in equilibrio, and producing, not motion, but rest—the doctrine of statics, as it has been called in modern times, as contra-distinguished from dynamics, which treats of bodies in motion. But it is not my intention in this brief notice, to treat

of his researches into this branch of science; I would rather allude to those mirrors with which he is said to have burned the Roman fleet, on its approach within bow-shot of his native city. This curious story is first mentioned by John Tzetzes and Zonaras, writers of the twelfth century, who cite Diodorus and others for the fact. But Galen, in the second century, though he mentions that Archimedes set the enemy's ships on fire, says it was done by *πύρια* (pyria), which may refer to any machine or contrivance throwing lighted materials.

This interpretation will, I am of opinion, satisfactorily solve what otherwise appears an improbable story. The possibility of making such powerful specula, especially by a combination of small plane mirrors, forming a surface of many faces, approaching to a curved concave form, has been shown by Buffon; but that this advanced knowledge, which was the result of unwearied diligence on the part of the French philosopher, was attained by Archimedes, is to me incredible, considering the low state of science at the time in which he lived.

W. G. Hall.

[*Πύρια* is a vague term which, as our correspondent intimates, may be applied to a tin saucepan, a steam-boiler, or a cannon. A speculum, or any other optical instrument of sufficient magnitude to produce the effect described at so great a distance, must be an erection difficult to move, and to suppose that the ships would come one after the other, and place themselves exactly in the focus, is too absurd even for the ancients to believe; but whatever they may say or believe, we are not compelled to forsake our reason and believe lies, because they told them 2000 years ago.—Ed.]

LIST OF NEW PATENTS.

John Duncan, of Great George Street, Westminster, gentleman, for improvements in machinery for cutting, reaping, or severing grass, grain, corn or other like growing herbs. Communicated by a foreigner residing abroad. Sealed November 2, 1840. (Six months.)

Elijah Galloway, of Manchester Street, engineer, for improvements in propelling rail-road carriages. Sealed November 2, 1840. (Six months.)

Josiah Pumphrey, of New Tower Row, Birmingham, brass-founder, for certain improvements in machinery to be employed in the manufacture of wire hooks and eyes. Sealed November 2, 1840. (Six months.)

Henry Wimshurst, of Limehouse, ship-builder, for improvements in steam vessels, in communicating power to propellers of steam-vessels, and in shipping and unshipping propellers. Sealed November 2, 1840. (Six months.)

James Heywood Whitehead, of Royal George Mills, York, manufacturer, for improvements in the manufacture of woollen belts, bands or driving-straps. Sealed November 2, 1840. (Six months.)

James Boydell, junior, of Cheltenham, for improvements in working railway and other carriages, in order to stop them, and also to prevent their running off the rails. Sealed November 2, 1840. (Six months.)

John Edward Orange, of Lincoln's Inn, Old Square, captain in the 81st Regiment, for improvements in apparatus for serving ropes and cables with yarn. Sealed November 2, 1840. (Six months.)

Herman Schroeder, of Surrey Cottage, Peckham, broker, for improvements in filters. Communicated by a foreigner residing abroad. Sealed November 2, 1840. (Six months.)

John Wordsworth Robson, of Wellclose Square, artist, for certain improvements in water closets. Sealed November 2, 1840. (Six months.)

Richard Farger Emmerson, of Walworth, gentleman, for improvements in applying a coating to the surfaces of iron pipes and tubes. Sealed November 3, 1840. (Six months.)

John Rapson, of Limehouse, millwright, for improvements in paddle-wheels for propelling vessels by steam or other power. Sealed November 3, 1840. (Six months.)

Henry Hind Edwards, of Nottingham Terrace, New Road, engineer, for improvements in evaporation. Sealed November 5, 1840. (Six months.)

Pierre Mathew Mannory, of Leicester Square, gentleman, for improvements in wind and stringed musical instruments. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months.)

George Gwynne, of Duke Street, Manchester Square, gentleman, for improvements in the manufacture of candles, and in operating on oils and fats. Sealed November 5, 1840. (Six months.)

George Dacres Paterson, of Truro, Esquire, for improvements in curvilinear turning—that is to say, a rest adapted for cutting out wooden bowls, and a self-acting side rest for other kinds of curvilinear turnings. Sealed November 5, 1840. Six months.)

Henry Kirk, of Blackheath, gentleman, for improvements in the application of a substance or composition as a substitute for ice for skating and sliding purposes. Sealed November 5, 1840. (Six months)

Charles Joseph Hullmandel, Great Marlborough Street, lithographic printer, for a new effect of light and shadow, imitating a brush or stump drawing, or both combined, produced on paper; being an impression from a plate or stone prepared for that purpose, as also the mode of preparing the said plate or stone for that object. Sealed November 5, 1840. (Four months.)

John Clarke, of Islington, Lancaster, plumber and glazier, for a hydraulic double-action force

and lift-pump. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months,)

George Delianson Clark, of the Strand, gentleman, for an improvement in purifying tallow, fats and oils for various uses, by purifying them and depriving them of offensive smells, and solidifying such as are fluid, and giving additional hardness and solidity to such as are solid, and also by a new process of separating stearine or stearic-acid from the elanie in such substances. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months.)

Alexander Horatio Simpson, of New Palace Yard, Westminster, gentleman, for a machine or apparatus to be used as a moveable observatory or telegraph, and as a moveable platform in erecting, repairing, painting, or cleaning the interior and exterior of buildings, and also as a fire-escape. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months.)

Andrew Kurtz, of Liverpool, manufacturing chemist, for a certain improvement or certain improvements in the construction of furnaces. Sealed November 5, 1840. (Six months.)

George Halpin, jun., of Dublin, civil engineer, for improvements in applying air to lamps. Sealed November 7, 1840. (Six months.)

William Crofts, of New Radford, Nottingham, machine-maker, for certain improvements in machinery, for the purpose of making figured or ornamental bobbin-net or twist-lace, and other ornamental fabrics, looped or woven. Sealed November 7, 1840. (Six months.)

Charles De Bergue, of Blackheath, gentleman, for improvements in machinery for making reeds used in weaving. Communicated by a foreigner residing abroad. Sealed November 7, 1840. (Six months.)

Thomas Lawes, of Canal Bridge, Old Kent Road, feather-factor, for certain improvements in the me hod or process, and apparatus for cleansing or dressing feathers. Sealed November 13, 1840. (Six months.)

William M'Kinley, of Manchester, engraver, for certain improvements in machinery or apparatus for measuring, folding, ploiting, or lapping goods or fabrics. Sealed November 10, 1840. (Six months.)

Charles Edwards Amos, of Great Guilford Street, millwright, for certain improvements in the manufacture of paper. Sealed November 10, 1840. (Six months.)

Thomas William Parkin and Elisha Wilde, of Portland Street, Liverpool, engineers, for an improved method of making and working locomotive and other steam-engines. Sealed November 12, 1840. (Two months.)

Eugenius Birch, of Cannon Row, Westminster, civil engineer, for improvements applicable to railroads, and to the engines and carriages to be worked thereon. Sealed November 12, 1840. (Six months.)

John Heaton, of Preston, overlooker, for improvements in dressing yarns of linen or cotton, or both, to be woven into various sorts of cloth. Sealed November 12, 1840. (Six months.)

MISCELLANEA.

Electricity of Steam.— The observation lately made by a workman at Seg Hill, near Newcastle-upon-Tyne, and described in the "Mechanic," of the electrical state of steam issuing from an opening on the top of a high-pressure steam-engine boiler, is not new. The fact has long been known to electricians; and a gentleman resident near this city, years ago, made some curious experiments on the electricity of vapours issuing freely into the atmosphere when liberated from the safety-valve of steam-engine boilers; and he considers the fact lately observed near Newcastle, to be a farther confirmation of his opinion, that the electricity of clouds is principally caused by evaporation from every moist surface—whether from that of water, leaves of vegetables, or moist soil, under the influence of the sun and wind.—*Hereford Journal.*

Anti-Railway Wit.—It is proposed to form, in connexion with some of the present railway companies, cemeteries on the new principle of making use of the spare land on the sides of the railways, and on the slopes of the cuttings and embankments, for the purpose of interring those who may from time to time be destroyed on the lines, whether passengers or servants of the companies. It is also proposed that the profits accruing from this source (which it is confidently expected will be considerable) should be applied to the establishment of hospitals at the respective termini, and at some of the principal stations, for the relief of those in whom life may not be at once extinct.—*Times.*

[In the course of investigating the circumstances of the late lamentable accident on the London and Birmingham Railway, it was shown that since the opening of that line, there had been travelled 89,885,000 miles by 1,349,000 passengers, not one of whom had died by accident, while of the Company's servants, but five or six in all had been killed. A surprisingly small amount, considering that the distance travelled is nearly as far as the sun from the earth. —Ed. Mec. & Chem.]

Predictions Fulfilled.—The admirers of cabalistic prognostications will be amused by the following calculations. If the year 1774 (death of Louis XV.) be taken, and its digits be successively added to the figure in the unit's place of that number, the year 1793 will be obtained (death of Louis XVI.) Thus $1774 + 1 + 7 + 7 + 4 = 1793$. If 1794 (death of Robespierre) be taken, and the same operation repeated, it will give 1815 (final fall of Napoleon); the same process applied to that year gives 1830 (fall of Charles X); and the same operation applied to 1830, gives 1842, of which the astrologer bids us *beware!* In the "Memoir of Josiah Quincy, of Massachusets," a name familiar to the history of the American revolution, we find in his journal the following remarkable entry:—"December 14th (1774). Spent the evening with Mr. Sayre, in company with Doctor Franklin and others. In the course of conversation, Dector Franklin said, that more than sixteen years ago, long before any dispute with America, the present Lord Camden, then Mr. Pratt, said to him, "For all what you Americans say of your loy-

alty and all that, I know you will, one day, throw off your dependence on this country; and, notwithstanding your boasted affection for it, you will set up for independence." If to the date of the prediction (1758) be added the sum of its digits (21) we shall have 1779; at which period the independence of the United States was virtually established, though not recognised by England till 1783.

Meteorology.—Effect of Wind upon the Atmosphere.—The following laws have been deduced from extended experiments by Kamtz and Dove. 1. The barometer falls under the influence of the east, south-east and south winds; the descent changes to ascent by the south-west wind; rises by the west, north-west and north winds; the ascent changes to descent by the north-east wind. This law is deduced from observations, made at Paris four times a-day, at first for five years, then for ten years, 1816—25. 2. The thermometer rises by the east, south-east and south winds; the ascent changes to descent by the south-west wind; falls by the west, north-west and north; the descent changes to ascent by the north-east wind. This and the following are believed to be based upon observations made at Paris and London, and have been confirmed by observations of Kamtz himself during four years. 3. The elasticity of aqueous vapour is increased by the east, south-east and south winds; its increase changes to decrease by the south-west wind; it decreases by the west, north-east and north winds, and its decrease changes to increase by the north-east wind. 4. The humidity of the atmosphere decreases relatively from the west wind, passing by the north to the east, and increases, on the contrary, from the east by the south to the west.

Overflowing of the Rhone.—The causes of the late inundation are thus explained in the French journals. The meteorological observations made in the city of Lyons give, as the measure of the rain which fell there during the 27th of October, and six following days, 32 centimetres, and 4 millimetres, or rather more than 12 1-8th English inches. The yearly average at Lyons being 54 centimetres, or 21 1-10th inches. To this phenomenon was added a burning southern and south-west wind, which prevailed during three weeks in the upper Alps, melting immense masses of snow, which sent down their fatal tribute.

As the workmen were digging a new paint-pit at Llanlinna, near Amlwych, they discovered within three feet of the surface a stone urn, on opening which they found a human skeleton in a high state of preservation, measuring the extraordinary length of seven feet six inches. The skeleton throughout was quite proportional to its length, and in very perfect condition. The urn appears to have been made from the Aberdovey limestone, and had the appearance of being much corroded by time. From the rude nature of this urn or coffin, it seems probable that the body had been first laid in the grave, and limestone placed round its sides and on the top only, which, from the length of time they had laid under ground, had become cemented together.—*Welch Paper.*

A Long Yarn.—The longest rope on record, in one unspliced piece, has just been finished in Sunderland. It is upwards of 400 yards long, seven inches in circumference, and twelve tons weight, and will cost about 400*l.* It is for the use of the London and Birmingham Railway.—*Leeds Intelligencer.*

Paris Railroad.—The original Paris station of the St. Germain, St. Cloud, and Versailles Railroad, which is now removed to the Rue St. Lazare, was in use three years and three months. During this period the number of passengers by the St. Germain line amounted to 4,114,260, and by the Versailles line, which was open only 14 months, to 1,643,694. Thus the total number of passengers by both lines was 5,757,000, being more than five times the whole population of Paris.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, December 30, R. Addams, Esq., on Acoustics. At half-past eight.

Pestalozzian Academy, Worship Square.—Tuesday, December 29, Mr. F. Wilby, on Vital Education.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 28, General Quarterly Meeting. At half-past eight precisely.

ADDRESS TO THE READERS OF THE MECHANIC AND CHEMIST.

ANNOUNCEMENT OF A THIRD SERIES.

CONSIDERING that it will be more convenient for our volumes to end with the year, we have determined on closing this volume with our last number, in December. We shall therefore commence our THIRD SERIES, with the first number in the new year, and in future, each volume will contain the whole of the numbers as issued in the particular year to which they belong, which, from the circumstances under which the work was commenced, has not hitherto been the case.

We are determined that the support our work has received, shall be met on our part by increased attention, and we solicit from our readers such communications as they consider calculated to interest their fellow-mechanics.

We would suggest to the operatives in our numerous manufactories, that much might be done, not only to improve the various machines, and the articles on which they are employed in producing, but in many cases to render their occupations more convenient to them-

selves, if they would send forth—as they may easily do through this work—such ideas as suggest themselves during their various operations. How frequently do they hear from each other, "What an improvement this or that alteration would be!" "How much more conveniently should we work, if such a change were effected in this or that machine!" And whatever the operatives may think, masters would gladly adopt these improvements, if reasonably and properly suggested. We feel convinced, that could the ideas of practical persons be collected, improvements would be made long before they are. When what is called a new invention comes out, how simple it appears, how wonderful that it was not before thought of. But what is the fact? Most of these things have often been thought of by others, but have not been put into shape and brought forward. Now we offer to such persons the means of rendering their thoughts useful to themselves and others; and we promise them, that their communications shall be promptly attended to, reserving, of course, to ourselves the right of selection.

Other mechanics' magazines have been published since the commencement of this work, but none of them have ventured to undertake the risk, expense, and labour, at the low rate of a penny each number; to distinguish therefore our work from others, we resume in this series the designation of the

PENNY MECHANIC AND CHEMIST.

Considering the expense of the numerous and complicated cuts contained in this work, it should be remembered that it is only by extensive circulation that it can be maintained; we would therefore suggest to those of our readers who think the work worth their attention, that they should recommend it to their friends and acquaintance. We cannot but think that to an operative it must be interesting to know what is going on in the mechanical world, and by the expenditure of ONE PENNY on a SATURDAY night, he may have an idea suggested to him that may lead to his advancement in the art which he follows.

We also wish to inform our correspondents, that we are anxious not only to receive communications strictly mechanical and chemical, but we also wish to obtain information of a generally interesting kind, connected with the arts and the artist. This is perhaps an extensive scope, for very little indeed is there in our present state of existence not connected with and dependent on them.

TO CORRESPONDENTS.

W. Simmons.—*Trewhitt's patent (enrolled June 4, 1840) does not relate to any improvement in the composition of earthenware; it consists in the substituting machinery for manual labour, by employing moulds or dies, and pressure, instead of the usual process of turning.*

A. A. (Liverpool), *and several other correspondents, propose plans for instantaneously detaching the engine from the train; but they have not informed what advantage they expect to derive from so doing.*

W. J. Cuthbert.—*We should be glad to see his papers on cheap philosophical instruments.—There is much truth in his "Hints to Querists;" it is unreasonable to expect that we should entertain the public with invidious recommendations of particular tradesmen; or that we should "go round to old iron shops to find out the cheapest place for buying old metal tubing" &c.—A reference to the past numbers of the "Mechanic," will show how many inquiries involving philosophical principles of general interest, have been fully and accurately answered by the Editor, or by our correspondents; but we cannot insert paragraphs which, under the guise of queries, are, in reality, advertisements, for which we should be liable to pay the duty; neither do we think it right to insert or answer questions upon subjects which are totally foreign to the intention of this work, or of so frivolous a nature, that they might be answered in any shop that deals in the articles referred to. But notwithstanding these little restrictions, we by no means wish to discourage legitimate querists. Past experience has proved how much useful information is derived from this source, and we shall continue to give our readers the best information in our power, or appeal to our correspondents for such specialities as we may be unacquainted with.*

J. C. B. *may obtain the essential oils from herbs, by distillation in a common retort, only taking care to keep the tube cool, otherwise the oil will escape in vapour. The operation of distillation cannot be performed without heat.*

A. S. M.—*The steam-guage was described in a former number of the "Mechanic"—it is constructed on the principle of the barometer, but with a certain portion of air above the mercury, to avoid the inconvenience of the great height of column which would be required to indicate the great pressure it has to sustain.*

ERRATUM.—Page 237, col. 1, line 23, for "pressure" read *pressers.*

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